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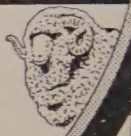

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QUEENSLAND AGRICULTURAL JOURNAL

Vol. LVI. 1 NOVEMBER, 1941 Part 5

Event and Comment

National Nutrition.

BETTER Nutrition—that is food, good food and plenty of it—does not mean soft living. It does not mean growing fat and lazy; and it does not mean concentrating our interest, or attention, on the flesh pots, the luxuries of life. On the contrary, better nutrition means becoming harder in physical condition, more efficient, and better able to work overtime when necessary, and finding it easier to do without luxuries when we have to.

In these days we do not know exactly what is ahead for us or the world, but we do know that we are going to be called on to make sacrifices. That is all the more reason for giving attention to the whole problem of nutrition now. By applying our brains, our knowledge, and our common sense to the use of our vast resources, we can be a well-nourished and efficient people, in spite of any sacrifices we may have to make.

Farmers have already learnt that when any large proportion of the population is on a poor diet, the market for farm products drops accordingly. Farmers can fare well only if the nation can eat well. That is a basic and simple truth which we all understand.

We are fortunate in that we have gone a fair distance towards stabilising agriculture in our own country, especially in respect of foodstuffs of high nutritive value, and that progressive policy is sticking to us in these days of national emergency. We are learning to control

acreage, store and hold surpluses, shift to other crops where possible, and divert products to other than the usual outlets. The alternative for farmers is a mad scramble of over production and soil exploitation in a desperate and vain effort to make ends meet at unpayable prices.

The big job, and a very difficult job, too, which we are now facing is to adjust primary production on a national scale. Once we are able to do this through sufficiently wide-spread co-operation and adequate administration, adjustments can be made according to the needs of any given situation. This would mean that a constant supply of food and feed could be turned at any time into the channels of consumption to meet any emergency.

As a matter of fact, in a comparatively small way an adjustment is already being made in our change-over from butter to cheese manufacture. In this respect, the dairy industry is fortunate that, unlike some of our other exporting industries, it has an alternative product. By changing over from butter to cheese we are meeting an abnormal export marketing situation, and are producing an easily transportable food of the highest nutritive value, and are so helping to maintain the health of the whole nation.

And to get back to the general question of nutrition, dietitians tell us that in cheese we have a complete food in a more or less concentrated form, and cheese is an excellent substitute for meat.

Whether it be for our children, our workers in every field of industry, or our fighting forces, the first essential is an abundant supply of the *right kind* of food. On a foundation of good food we can build almost anything. Without it we can build nothing.

The Conversion of Feeding Stuffs to Food for Man.

IT is the aim of many farmers to make their grain walk off the farm in the shape of cattle, pigs, and poultry, and, in suitable circumstances, it's a good idea. In the Old Country, the nutritional experts have been very busy getting together a lot of information from a large number of experiments and a great variety of sources, and they have compared the relative efficiencies of animals in producing protein, fat, and energy. To do this, different periods in the life of the animals were chosen.

The efficiency of fattening the mature bullock or pig can best be compared with that of a cow in full milk; while the efficiency of the bullock from birth to slaughter is, for baby beef, to be compared more with a complete year in the life of the cow, and, for the two to three-year-old bullock, with the whole life of the cow. The feed expenditure put down for pork and bacon pigs covers only the period from weaning to slaughter, but actually the expense of rearing from birth to weaning would make only an insignificant reduction in efficiency. The efficiency of egg production is on the same basis of comparison with that of milk production.

Taking all these points into consideration, the investigators conclude that the cow producing 6 gallons of milk every day is more efficient, in all respects, than any of the other animals. Even at the productive level of 4 gallons a day, the cow is superior—except in fat production, in which she is beaten by the pig. The hen laying an egg every day competes with the cow—relatively, of course—or equals the cow in protein production.

Over a year, the average 600-gallon cow is beaten in fat production by the pig, but only good hens, laying as many as 200 eggs in the year, equal the cow in protein production.

For meat production, the pig is more efficient in all respects than beef cattle. Poultry produce meat protein more efficiently than either cattle or pigs, but produce fat much less economically.

This aspect is receiving considerable attention in Britain to-day, where the aim is to allocate animal feeding stuffs to the classes of live-stock that can do most to meet the needs of the people over there.

Out of this war are coming many new ideas, and we are certainly reducing the science of feeding both man and beast to a fine art. And this remarkable fact has emerged from two years of war rationing in the Old Country. The health of the people in the Homeland has, on the whole, improved greatly as compared with the pre-war standard. That fact would seem to strengthen the belief that many of us eat far too much and, for some of us at least, the best physical exercise is pulling the chair away from the table.

Transport of Milk from Shed to Roadside.

WITH the change-over on many farms from the supply of cream to butter factories to the supply of milk to cheese factories, quite a few problems have cropped up with dairy farmers. And not the least of these difficulties is the job of getting the much bulkier milk—one can of cream equals ten cans of milk—from the dairy to the roadside, where a pick-up milk transport service has been arranged. Cartage thus becomes a big undertaking, seeing that it has to be done every day, even where there is a good track from the shed to the roadside. And a dirt road in wet weather—well, we all know what that means. The construction of a permanent all-weather drive cannot be done cheaply, either. Some New Zealand farmers in districts where wet winter and spring conditions cause water-logging of their land have got over the difficulty by building a trolley to run on lines between the dairy and the roadside. Apart from a set of flanged wheels and axles, the only materials needed in its construction are timber, nails, and bolts. The trolley line is made of 3 x 2 hardwood rails, laid on rough round-backed sleepers spaced 4 feet apart. The rails are placed on edge to give a 3-inch depth, and are held in position with 6-inch spikes driven right through into the sleepers. The track for such a trolley line should, of course, be rough-levelled, and the rails spaced about 3 feet 3 inches apart, or, in other words, on 3 feet 3 inch gauge. To make the trolley rails last long, each length could be treated with creosote, although that may not be essential.

Trolleys can be built in various sizes to meet individual requirements, but should be high enough to avoid a big lift of the milk cans from the deck of the trolley on to the milk-collecting lorry. It is not easy to juggle a full milk can weighing, say, up to a couple of hundred pounds, and when many cans have to be handled the work can become very exhausting. The trolleys used for this purpose are usually about 3 feet 6 inches high. The four flanged wheels are about 15 inches in diameter and coupled by 2-inch axles. Length and width can be varied to suit individual requirements. Where a trolley line has to be taken across wide, open drains heavy stringers or girders—hardwood logs, say, squared on top to take the rails—are needed to support the trolley line.

Such a milk trolley and track are certainly worth thinking about, especially in black-soil country likely to become boggy in wet weather.

Notes on the Papaw and its Improvement in Queensland.

G. W. J. AGNEW, Q.D.A., Q.D.D., Nambour Research Station.

THE value of the papaw has gradually become recognised since its introduction to Queensland as an exotic tropical fruit in the early days of settlement, and it now plays a significant and not unimportant role in the fruit industry of the State. (Plate 112.)

Much information on papaws has been accumulated in countries where this crop has been the subject of investigation at various times over the past half century or so, notably in the Hawaiian Islands, the Philippine Islands, and more recently in the Union of South Africa. During the last three years horticultural research in Queensland has expanded considerably, and the study of the papaw as a crop plant has formed part of that expanded programme.

The results of recent work both in Queensland and overseas should give considerable encouragement to those interested in the culture of this plant. Indeed there is good reason to believe that the status of the papaw as a commercial fruit can be considerably improved; but, if this is to be accomplished, it is necessary from the outset for growers to obtain a correct picture of the present position, and to realise that the only methods by which the desired results can be achieved are those based on sound botanical knowledge and principles.

THE NEED FOR FRUIT IMPROVEMENT.

The great majority of marketed papaws present an almost unclassifiable bulk when compared with the standards set by other fruits. In general, there is considerable variation in flavour, colour, size, shape, and in fact in most of the principal features which govern the quality of the fruit. Many of the variations in fruit characters are unattractive, thus giving rise to fruits of inferior quality. With most other commercial fruits, standardisation is made possible by the production of fixed varieties, but no true horticultural varieties of the papaw are grown in Queensland comparable for instance with those of the apple, grape, or orange, which are vegetatively propagated and thus provide fruit with a high degree of varietal uniformity and distinctiveness. There are, however, very promising individual papaw trees which, from lack of a suitable means of perpetuation, lose their value as potential parents of superior varieties. A most immediate need, therefore, is the production of fixed uniform papaw varieties of superior type, in order to obtain standardisation combined with high quality.

The distinctive features which render it possible to differentiate between superior and inferior papaw fruit types, are the result of intrinsic differences in the characters of individual plants, and must not be confused with the minor transient variations in fruit quality, such as the impairment of flavour in winter-maturing fruits grown towards the lower limits of the sub-tropics, and which are the result of environmental influences.

In general, papaws are naturally adapted to cross-fertilisation and this has enabled interbreeding to take place between numerous widely

divergent strains. Thus the increase in the number of trees since the earliest introductions were made, has been accompanied by a comparable increase in the number of types. An examination of almost any papaw plantation discloses great dissimilarity in fruit types, and indeed it is often difficult to find several trees which closely resemble one another.

Papaws are commonly propagated by seed obtained from individual fruits chosen in packing sheds and farm kitchens, or from seed collected in bulk from canning factory refuse. The multiplicity of fruit types present in plantations is therefore not surprising, because little or no cognisance is taken of the nature of the seeds, and their all important influence on the characters of the plants which are produced from them. If control is to be exercised over material propagated with the object of producing fruits of superior type, it is essential that papaw growers become seed conscious, and that they possess a working knowledge of papaw flowers and their relation to fruit production, their function in the plant reproductive process, and their influence on breeding behaviour. Papaw flower and plant types are accordingly discusssed in the following paragraphs.

FLOWER AND PLANT TYPES AND THEIR RELATION TO FRUIT PRODUCTION.

A great deal of misunderstanding exists with regard to the occurrence and function of papaw flowers. This is attributable to the complexity of flower and plant types.

Plate 112.

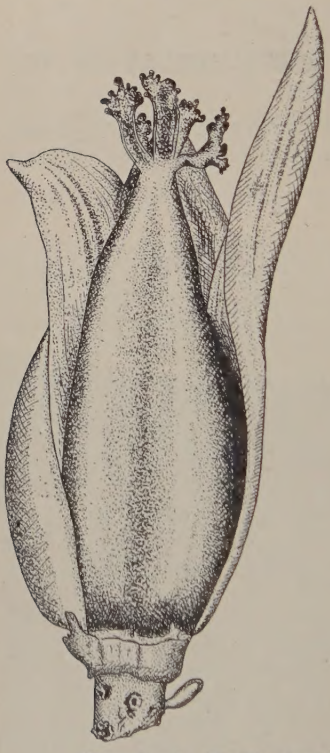
TYPICAL QUEENSLAND HILLSIDE PAPAW PLANTATION.

Flower Types.

Most species of flowering plants bear hermaphrodite flowers, with the reproductive organs of both sexes in combination, that is, both pistil and stamens occur within the same flower. There are, however,

three primary flower types (Plate 113) in the papaws, namely pistillate, staminate, and hermaphrodite or bisexual, and individual trees may bear one, two, or very rarely all three of these. Generally where more than one flower type occurs in a single plant, their co-existence is for brief periods only.

Plate 113.
PRIMARY PAPAW FLOWER TYPES.



[*Drawing by W. W. Manley.*
Plate 114.
PISTILLATE PAPAW FLOWER.

Pistillate flowers (Plate 114) are those which express the characters of femaleness only. They have five petals, free for their entire length, surrounding the female reproductive organ, the pistil, which is the flask-shaped structure protruding outwards from the centre of the flower. The upper portion of the pistil, the stigma, opens its five crinkled lobes at full bloom as receptive surfaces for pollen. The lower bulbous part of the pistil is the ovary, which is hollowed to form a cavity attached to the lining of which are the ovules, or seeds-to-be (Plate 115).

Flowers in which maleness only is expressed are staminate (Plate 117). The comparatively small petals of these flowers are fused together for slightly over half their length, forming a slender tube, which bears the stamens or male reproductive organs. There are ten stamens, each of which has a yellow lobed anther at its apex. The anthers produce pollen which is liberated in the late bud stage, just prior to the opening of the flower. Staminate flowers cannot produce fruit, since the pistil which takes the form of a fine thread with a bulb at the base is rudimentary and functionless.

Hermaphrodite flowers of the papaw are classified into three types, pentandria, intermediate, and elongata, according to the nature of their structural modifications. The importance of the various flower structures lies in the effect which they produce on fruit type. The pentandria type (Plate 118) is somewhat similar in general features to the pistillate type, except that it has five large stamens which arise near the base of the petals, and lie along grooves on the outer surface of the ovary. Pentandria flowers produce a typically squat fruit with deep grooves and well defined petal scars at the base of the fruit. The intermediate type (Plate 119) comprises an indefinite group of freakish and distorted

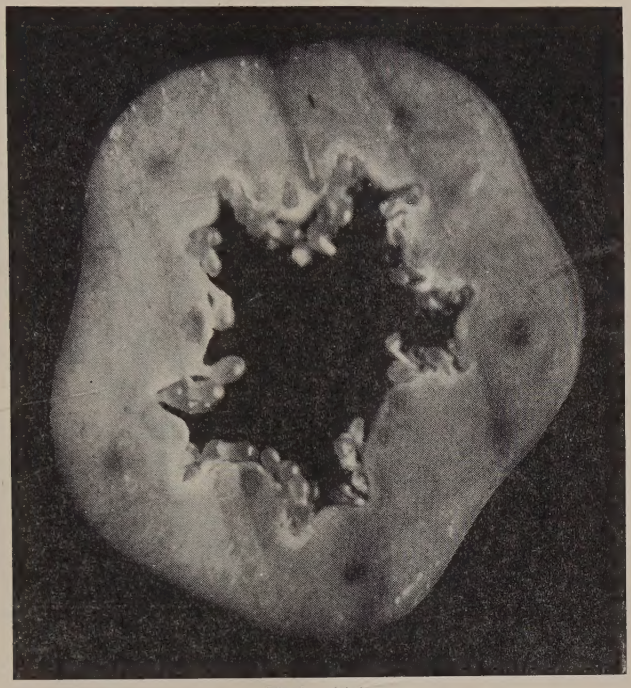


Plate 115.

CROSS SECTION OF THE OVARY OF A PISTILLATE PAPAW FLOWER SHOWING OVULES.

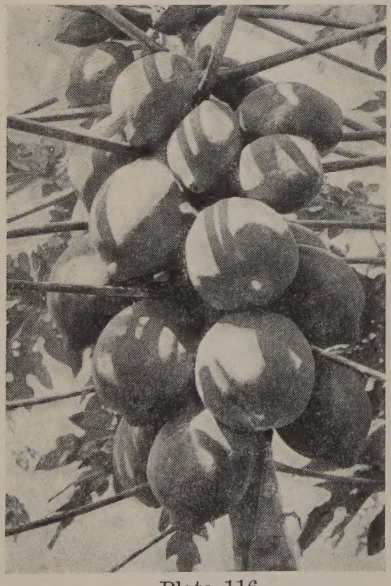


Plate 116.

FEMALE PAPAW TREE IN BEARING, SHOWING FRUIT PRODUCED BY PISTILLATE FLOWERS.

flowers, exhibiting various degrees of sexual development; malformed stamens and pistil are present in many grotesque associations. Fruits produced by intermediate flowers are extremely irregular in structure, and usually are of no commercial value.

The elongata (Plate 120) is the commonest hermaphrodite flower type. It has an elongate pistil partly enveloped by the petals which are united for portion of their length, thus forming a collar around the ovary. There are ten stamens attached to the throat of the petal tube. Elongata flowers give rise to long fruits resembling in this respect a cucumber or they may be pear shaped. The seed cavity is comparatively small and often takes the form of a number of deep fissures, from which seeds are difficult to extract.

Dioecious Papaw Plants.

Plants normally bearing either pistillate or staminate flowers only are collectively referred to as dioecious. Colloquially, trees bearing pistillate flowers are termed "females," whilst those which normally bear staminate flowers only are referred to as "males."

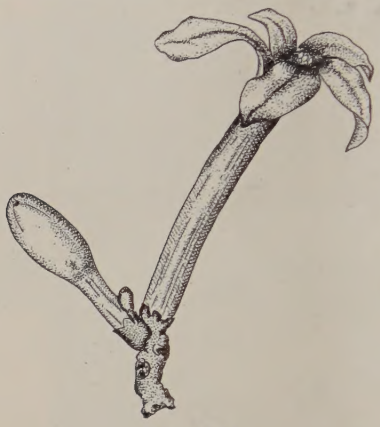


Plate 117.
STAMINATE PAPAW FLOWER.

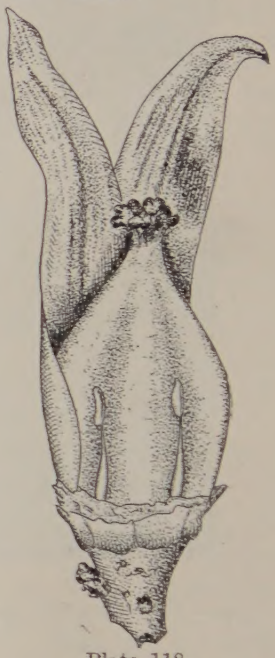


Plate 118.
PENTANDRIA TYPE OF HERMAPHRODITE PAPAW FLOWER.

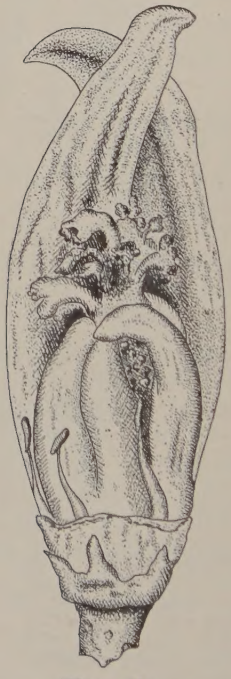


Plate 119.
INTERMEDIATE TYPE OF HERMAPHRODITE PAPAW FLOWER.

Plate 120.
ELONGATA TYPE OF HERMAPHRODITE PAPAW FLOWER.

[*Drawings by W. W. Manley.*

Plate 121.
FEMALE FRUITS SHOWING VARIABILITY IN TYPE DUE TO STRAIN DIFFERENCES.

The flowers of female trees are produced on single or but simply branched stalks varying from one to several inches in length, according to the characteristics of the strain. A principal flower is borne at the apex of the flower stalk, and smaller subsidiary flowers appear on the flower stalk further back towards the leaf axil. The size and number of subsidiary flowers varies considerably on the one tree during the flowering season as well as between trees of dissimilar strain.

Fruits produced by the pistillate flowers of female trees are usually rounded or oval in general outline (Plates 116 and 121), whilst common

Plate 122.
MALE PAPAW TREE IN BEARING, SHOWING FRUIT PRODUCED BY SEASONALLY OCCURRING REDUCED HERMAPHRODITE FLOWERS.

irregularities occur in the form of beaked fruits or fruits which taper away at the stalk end.

The staminate flowers of male trees are produced in large numbers on profusely branched stalks, which attain a length of from three to five feet. Some male trees bear a number of reduced hermaphrodite flowers at the terminals of these stalks, particularly during the cool spring and autumn months. The pistils of these flowers become sufficiently developed to enable them to produce fruit (Plate 122) and large crops may be produced in this way, though the fruits are extremely variable in quality and are often of inferior type (Plate 123).

Plate 123.

Papaw Fruit Types Produced by Hermaphrodite Flowers on Male Trees.

Hermaphrodite Papaw Plants.

All three hermaphrodite flower types are produced on flower stalks in a similar fashion to that of pistillate flowers on female trees. In the case of hermaphrodite flowers, however, the subsidiary flowers are in many instances functional staminate ones or abnormal hermaphrodites. In some cases, and particularly during the cool months, staminate flowers may be almost exclusively produced, and the trees then become virtually functional males for a limited period.

Plate 124.

Hermaphrodite Papaw Tree in which the Pentandria Flower Type Predominated.

Plate 125.

Hermaphrodite Papaw Tree in which Elongata Flower Type Predominated.

The three types frequently occur in the same tree, generally with pentandria (Plate 124) and elongata (Plate 125) predominating from time to time during the flowering season. In other trees again, one of the three types, commonly elongata, predominates throughout the life of the plant.

In Queensland, trees which bear practically all elongata flowers and which characteristically produce long narrow fruit, are popularly called "Long Toms." At one time this term may have signified one distinct strain, but at present it is applied indiscriminately to any long-fruited strain, and the use of the term Long Tom as representing a horticultural variety is now misleading.

Fruit produced by pentandria, intermediate and elongata hermaphrodite flowers are illustrated in Plates 126, 127, and 128.

POLLINATION AND FERTILIZATION.

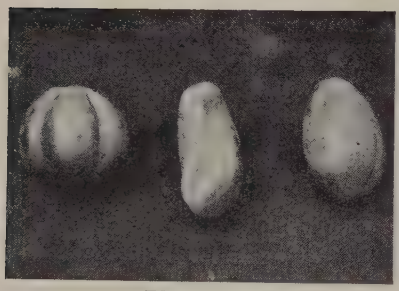


Plate 126.

PAPAW FRUIT TYPES PRODUCED BY PENTANDRIA, INTERMEDIATE, AND ELONGATA HERMAPHRODITE FLOWERS.

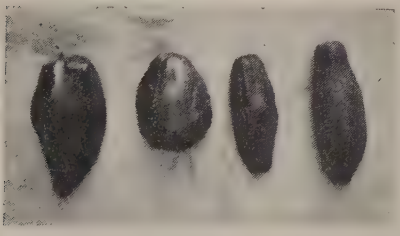


Plate 127.

ELONGATA HERMAPHRODITE PAPAW FRUITS SHOWING VARIABILITY IN TYPE DUE TO STRAIN DIFFERENCES.

Pollination is the act of placing pollen on the surface of the stigma of the female reproductive organ. In order to pollinate pistillate flowers of a female tree, pollen must be transferred from the staminate flowers of a male tree, or from flowers of hermaphrodite trees. Hermaphrodite trees, on the other hand, may be self pollinated, though cross pollination with males and other hermaphrodites can and does occur.

The very small pollen grains of the papaw are shed in large numbers and their transference to the surface of the stigma takes place principally by wind action. Flower-visiting insects have not been observed to act as important agents in distributing papaw pollen. In certain districts, however, bees are occasionally seen gathering pollen from the flowers of male trees, but the pistillate flowers of female trees do not appear to be particularly attractive to them, though in a few instances bees have been recorded working in these flowers also.

Pollen grains are living plant tissue, and when placed in a suitable medium such as that present on the surface of the stigma, each grain develops a pollen tube which grows down through the pistil. The specialised male sex cell carried in the pollen tube, eventually unites with the female sex cell in one of the ovules within the ovary. Fertilisation of the ovule has thus been accomplished, and the product of the union of male and female sex cells becomes the foundation for the development of the seed.

A well-seeded papaw fruit may contain a thousand seeds or more, and every seed in the fruit represents a fertilised ovule in what was

originally the ovary of the flower. Remembering the possibilities of chance pollination by wind, it is apparent that in a field of mixed types, any one flower may receive pollen from numerous sources, and as a result, seeds of the same fruit may have a mixed male parentage.

Plate 128.

FRUITS OF A HERMAPHRODITE PAPAW TREE IN THE EARLY STAGES OF DEVELOPMENT.—The lower fruits have been produced by elongata flowers, and the centrally-placed malformed fruits by intermediate flowers. Flowers in the top centre are Pentandria hermaphrodites.

IMPROVEMENT BY SELECTION.

Whilst certain cultural practices may tend to improve the crop being treated by helping to bring out the characters of the plant, such treatment cannot change an inherently bad papaw into a good one.

Every papaw plant carries with it hereditary substances, supplied by both male and female parents, which govern its reactions from the initial one-celled stage on to maturity. Thus any real improvement in the characters of the plant concerns its germinal or hereditary constitution, and since heritable characters are determined by the interaction of numbers of inherent or genetical factors, it follows that progressive selection must result in bringing about a greater summation of the factors which make for improvement, thereby raising the standard towards the ideal.

In the past, some growers with isolated dioecious plantings have achieved a certain degree of improvement by mass selection methods, consisting of the eradication of off-type females and weak males followed by the maintainence of a continuity of seed supply from the best female trees only. Unfortunately much of the value of these attempts has been lost as a result of the subsequent introduction of

inferior types, particularly when the introductions have been of hermaphrodite strains.

ESTABLISHING PURE LINES.

With dioecious papaws, male and female parental lines are selected and purified by brother x sister matings and the culling of off-type individuals for several generations in order to obtain pure breeding varieties. Work done in the United States of America and in the Union of South Africa (United States Department of Agriculture, 1937, and Hofmeyr, 1938) has shown that the desired horticultural characters can be fixed and maintained by selection in this manner.

A programme to establish pure lines from locally selected and introduced strains is already in progress in Queensland, but as with any similar programme, several years must elapse before selected material has been purified and tested.

The establishment of fixed hermaphrodite varieties is a subject undergoing investigation. At present it appears that it is not possible to obtain true breeding hermaphrodite strains owing to the unstable nature of their complicated sexual constitution, as will be seen from the results obtained in the study of sex inheritance.

INHERITANCE OF SEX IN THE PAPAW.

Queensland papaw plantations vary considerably in their distribution of sex types. There are wholly dioecious plantings and others with a majority of hermaphrodites but, in the main, plantations consist chiefly of dioecious plants interspersed with a few hermaphrodites. Growers must therefore be familiar with some of the facts concerning the distribution of sex in the progenies of the different possible matings among the common sex types.

The study of sex inheritance in the papaw is at present undergoing investigation by geneticists. Though it is not within the province of this paper to deal with this subject, the following information presented by Hofmeyr (1938) and Storey (1938) from independent investigations is of interest and importance.

Parentage.	Progeny Ratios.
Female x male.	Females and males 1 : 1.
Female x elongata hermaphrodite.	Females and hermaphrodites 1 : 1.
Elongata hermaphrodite x male.	Females, males, and hermaphrodites 1 : 1 : 1.
Elongata hermaphrodite self fertilized.	Females and hermaphrodites 1 : 2 (Hofmeyr).
	Females, hermaphrodites, and males 1 : 2 : .05 (Storey).

An important point which can be discerned from this segregation table is that of the elimination of male trees from the progenies of the matings, female x elongata hermaphrodite, and their virtual if not actual elimination from self-fertilized elongata hermaphrodites. Thus by breeding in this manner a reduction in the number of non-bearing trees is brought about, thereby saving time in planting operations and increasing the total yield of a plantation. It is assumed that hermaphrodite trees can adequately displace male trees as pollinators. Whilst this is possible, sufficient evidence has yet to be obtained to show that this is so under the conditions prevailing in South and Central Queensland coastal areas.

POINTS IN THE SELECTION OF THE FEMALE PARENT.

The following points indicate the most important features to be aimed at in the selection of the female parent:—

(1) Vigorous growth as indicated by robust development is an essential characteristic.

(2) A short though stout trunk with low fruiting habit is desirable. Low fruiting avoids many harvesting difficulties, particularly with the second and subsequent crops. It may be noted that a reasonably low set of fruit can be attained with many of the common papaw types by planting the seed in early January and transplanting to the field in late March or April.

(3) Fruit spacing on the trunk should be free, preferably with one fruit to each leaf axil. If subsidiary fruit development be too prolific, crowding results and this can be obviated only by continuously thinning out during the flowering season.

(4) Smooth-surfaced and oval-shaped fruits, weighing from 3 to 4 lb., are the most readily saleable either as fresh fruit or for canning in all marketing centres.

(5) Fruit skin colour is an important consideration. This character is subject to much modification by environmental conditions and the value of good colour is often nullified by disease spots and blemishes. Richly-coloured types are considerably more attractive than those maturing with mottled skins, or those which on ripening show little change in colour from the immature green.

(6) Fruit flavour is probably the most variable character in the papaw and even on the one tree the flavour fluctuates from season to season. A sweet and distinctly pleasant flavour is required.

(7) A good papaw must have a firm flesh with average thickness of from 1 to 1½ inches, with a bright orange colour.

SELECTION OF THE MALE PARENT.

Owing to the fact that some male tree must be chosen and that any characters of fruit production it will be likely to confer on its progeny are unknown, it is necessary in the first instance to make several male parent selections.

An endeavour should be made to ascertain the past history of the proposed male stock in order to utilise, as far as possible, the qualities of superior strains. Vigorous males which flower prolifically should be chosen. These males can then be mated with the same chosen female and their progenies maintained separately to enable comparisons to be made and thus determine which are the most desirable parents.

CONTROLLED HAND POLLINATION WITH DIOECIOUS PAPAWS.

Following the selection of male and female parent plants, it is necessary to carry out the actual process of pollination under controlled conditions so as to obtain pedigreed seed. The operation of hand pollination for pedigreed seed production is one in which every care must be exercised to guard against contamination by foreign pollen.

The operation is carried out in the following manner. The flowers of the female tree are covered with paper bags a day or two prior to their opening; paper bags 4 inches by 2 inches, as used for certain

confectionary purposes, have been found to be suitable. All subsidiary flowers on the principal flower stalk are removed and the bag is slipped over the large apical bud, and clipped tightly onto the flower stalk with a paper clip or fastener, so as to prevent the ingress of foreign pollen. When the pistillate flower opens inside the bag pollen is dusted from flowers of the selected male tree on to the surface of the stigma, and the bag is again quickly placed in position to cover the flower. The transference of pollen is easily accomplished by removing the unopened petals from late stage staminate flower buds, and then using the remainder of the flower as a brush. Pollen is shed in the staminate flower just before the petals open, and it is therefore necessary to take the staminate flower at this stage.

The pollinated flower is appropriately labelled, the female and male parentage being recorded on the label. For this purpose small commercial tag labels, which have been dipped in hot paraffin wax after marking, are useful and are durable and of sufficient size for convenience in handling. The loop of the tag is slipped over the bagged flower and is held on the flower stalk.

Seven days following the operation of pollination, the bag can be removed, when it is obvious from the increase in size of the ovary and the brown discolouration of the stigma that fruit setting has occurred.

During the flowering season an average of about three flowers are produced each week on each plant, though these may not all be in a receptive condition at the same time. Each flower subjected to controlled hand pollination is the potential bearer of from 500 to 1,000 seeds at the maturity of the fruit. It is advisable to treat three to four times the number of flowers estimated to give sufficient seeds for minimum planting requirements, to allow for losses resulting from injuries to the fruit or poor seed germination.

Plate 129.

PAPAW TREE BEARING CROP OF WELL-FORMED, EVENLY-DEVELOPED FRUIT, INDICATING FAVOURABLE NATURAL POLLINATION.

FRUIT AND SEED SETTING.

Normally, effective fruit development depends upon successful fertilisation of the ovules, resulting in fully-formed and well-seeded fruits. (Plate 129.) In the central and south coastal districts, however, it is common to find trees bearing a number of undersized, seedless, and near-seedless fruits, particularly on female trees. These fruits may drop off in the early stages of development or they may be carried to maturity. All degrees of fruit size are encountered, from those almost fully developed to those about the size of a hen's egg. (Plate 130.) The weight and size of the fruit is roughly proportional to the number of seeds set, varying with the individuality of the tree, and with seasonal conditions at the time of flowering.

Plate 130.

PAPAW FRUITS SHOWING THE REDUCTION IN SIZE AND THE VARIATION IN SHAPE RESULTING FROM DEFECTIVE POLLINATION.

From their experience in the Madras Presidency of India, Cheema and Dani (1930) concluded that seedlessness in the papaw is due to lack of pollination. Recent investigations in Queensland have confirmed this conclusion, except that there are cases where seedlessness is a heritable characteristic. In describing the occurrence of seedless papaws in the Union of South Africa, Hofmeyr (1938) states that climate and deficiency of available pollen are probably the determining factors.

At times when pollen has been abundantly produced by male trees which have comprised as much as 10 per cent. of the tree population, examinations have shown that only a small proportion of the fruit developed with a full complement of seed, as the result of natural field pollination, whereas flowers hand pollinated at the same time produced well-seeded fruits.

Plate 131.

PAPAW TREE SHOWING THE REDUCTION IN THE NUMBER OF FRUIT RESULTING FROM DEFECTIVE POLLINATION.

At certain times of the year, flowers which have been covered to prevent pollination, have produced small seedless fruits parthenocarpically, that is without the stimulus of pollination and fertilization. When defective pollination thus occurs, trees which bear a large number of subsidiary flowers often produce a large crop of small seedless and near seedless misshapen and crowded fruits.

Observations in South Queensland during 1939, 1940, and 1941 showed that, with occasional exceptions, staminate flowers of male trees produced large quantities of pollen throughout the flowering season, which extends from October to July. There were, however, brief

periods when pollen was not produced, though there was an abundance of flowers. Two such periods were observed during the 1940-41 flowering season. These definite non-functional periods were of two to three weeks' duration, and during them pollen was absent in the mature anthers of staminate flowers; the presence of pre-pollen forms, or tetrads, in mature anthers confirmed the fact that pollen abortion had taken place.

Defective pollination is considered to be one of the chief cultural problems of dioecious papaws in the central and south coastal areas of Queensland, and it is therefore at present a subject of investigation. It is responsible for a considerable falling off in yields because of a reduction in the size and number of fruits (Plate 131), for irregularity in fruit shapes within the one tree and, in certain instances, for permitting prolific subsidiary fruit development, resulting in a crowded undersized crop. At the present time hand pollination appears to be the only suitable corrective available, but the limit of its practical application is exceeded in plantations of tall trees, where difficulties are encountered in handling flowers to be pollinated.

Occasionally trees are found which bear almost an entire crop of fully-developed fruits, which are seedless or which have only one or two seeds in some of the fruits. The ovules in these instances are shrivelled and shrunken even in the bud stage of the flower, which suggests embryo abortion. There is evidence to show that this condition of seedlessness is a heritable character. At Nambour seedlessness has reappeared in the progeny of a plant selected for this character.

ASEXUAL PROPAGATION AS A MEANS OF MAINTAINING SUPERIOR FRUIT TYPES.

Plate 132.

DECAPITATED PAPAW TREE SHOWING FORCED OFFSHOOTS WHICH ARE USED AS SCIONS.

The grafting of papaws has received attention in tropical and subtropical countries during the past half century, with the object of avoiding losses due to the culling of male trees, and as a possible means of perpetuating selected strains and retaining uniformity of type. A grafting technique was worked out by Fairchild and Simmonds (1913) in the Hawaiian Islands and by Wester (1916) in the Philippine Islands, and propagation by cuttings has also been accomplished.

Reports of previous research have indicated the impracticability of commercial asexual propagation with the papaw. Experience in Florida showed that grafted trees lost vigour and degenerated rapidly to worthless types. Pope (1930) stated that: "With present knowledge of the species it is useless to practice vegetative methods of propagation as both environmental and hereditary variations frequently occur."

A simple cleft or wedge graft is employed in grafting papaws in Queensland, and grafting is most successfully accomplished in the hot dry months. Eight to ten weeks old seedlings are used as stocks, and the scion wood is taken from offshoots of selected parent trees. (Plate 132.) Initial grafting studies in this State were chiefly concerned with technique, and there is a field of grafted trees in full crop in which investigations are now proceeding. In order to examine the nature of the apparent degeneracy and loss of vigour in grafted trees, the life histories of a number of clones will be studied over several asexual generations.

A number of difficulties are encountered in grafting papaws on a large scale. Scion wood is not abundantly produced even when forced by decapitating the female tree, and allowing the shoots to develop. Offshoots, which are to be used as scions, vary considerably in vigour because they arise from different parts of the parent stem, and this makes uniformity in nursery stock-scion sizes difficult to obtain.

Plate 133.
GRAFTED PAPAW TREE IN FLOWER.

Plate 134.
GRAFTED PAPAW TREE IN FULL BEARING.

The economic life of the average papaw plantation extends over only three or four yearly crops. Such a short span of usefulness requires that propagation should be simply and easily carried out, and the attendant difficulties associated with grafting papaws for commercial planting are such that the economic value of asexual propagation is very doubtful. The method may, however, prove to be of more importance in the perpetuation of plants required for breeding purposes. (Plates 133 and 134.)

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BUSHEL WEIGHTS.

For the information of farmers, the following list of bushel weights is given:—

	Lb. per bushel.		Lb. per bushel.
Barley	50*	Peas	60*
Beans	60*	Pollard	20*
Bran	20*	Prairie	20
Cowpeas	60*	Rape	56
Grass Seeds	20	Rhodes Grass	20
Lupins	60	Rye Corn	60*
Maize	56*	Rye Grasses	20
Mangel	20	Setaria	60
Meals	20	Sorghum	60
Millets	60	Soy Bean	60
Oats	40	Tares	60
Panicum	60	Vetches	60
Paspalum	20	Wheat	60*

* Indicates the legal standard as fixed by *"The Weights and Measures Act of* 1924."

The ton is fixed at 2,240 lb. except for bran, pollard, and flour, which shall be 2,000 lb.

It should be noted that the Imperial bushel as used in Australia contains 2,218.2 cubic inches, whereas in the U.S.A. it is known as the Winchester bushel and contains 2,150.4 cubic inches.

Bean Fertilizer Investigations During 1941.

W. A. T. SUMMERVILLE, M.Sc., Senior Research Officer.

THE investigation of the fertilizer requirements of beans on the North Coast was carried forward a further stage during the 1941 season and, though the weather conditions were for the most part very adverse, much additional useful information was obtained and satisfactory progress can be claimed.

Field Experimental Work.

The main field experimental work consisted of tests of various levels of each of the three major fertilizers. From the report of the first series of experiments, which was published in this Journal in April, 1941, it was obvious that both nitrogen and phosphoric acid were required for the successful growth of beans, but that the addition of potash to any of the soils under investigation was apparently not followed by any great increase in the yield obtained.

After the establishment of the basic qualitative requirements of the plant in respect to the major fertilizers, the next step was to investigate the effects produced by known quantities of each. Accordingly this season two levels tests were conducted. These were located at Buderim and Cooroy, respectively, and the actual layout was essentially the same in each case. Sulphate of ammonia and superphosphate were each applied at three levels of 1 cwt., 2 cwt., and 3 cwt. per acre, whilst sulphate of potash was applied at the rate of ½ cwt. and 1 cwt. per acre and in one-third of the plots was omitted altogether. These levels were combined in every possible manner thus giving twenty-seven mixtures. In order that the method may be more clearly understood, the following examples of combinations employed are given:—

Combination.	Sulphate of Ammonia.		Superphosphate.		Sulphate of Potash.
No. 1	1 cwt.	+	1 cwt.	+	0 cwt.
No. 2	1 cwt.	+	1 cwt.	+	½ cwt.
No. 3	1 cwt.	+	1 cwt.	+	1 cwt.
No. 4	1 cwt.	+	2 cwt.	+	0 cwt.
No. 5	1 cwt.	+	2 cwt.	+	1 cwt.
No. 6	1 cwt.	+	2 cwt.	+	½ cwt.
No. 7	1 cwt.	+	3 cwt.	+	0 cwt.
No. 8	1 cwt.	+	3 cwt.	+	½ cwt.
			and so on up to		
No. 27	3 cwt.	+	3 cwt.	+	1 cwt.

The Cooroy plots were very badly washed by a sudden heavy fall of rain, and this was followed by strong westerly winds. The numbers of plants in the plots were consequently uneven and the run off of water along the rows made it rather risky to draw conclusions from these plots. On the other hand, very good results were obtained from the Buderim plots, and these were so clear cut that they can be accepted at their face value.

The accompanying graph (Plate 135) gives a very good summing up of the position as it was seen at Buderim. This may be elaborated as follows:—A level of 1 cwt. of sulphate of ammonia per acre appears to be the maximum required on this soil. Not only did further amounts

of sulphate of ammonia not increase the yield, but they actually led to a marked decrease. This decrease was, in fact, highly significant, and there is no doubt that this fertilizer in excess of 1 cwt. per acre is either just a waste of material or produces a still greater loss through an actual lowering of the amount of beans harvested.

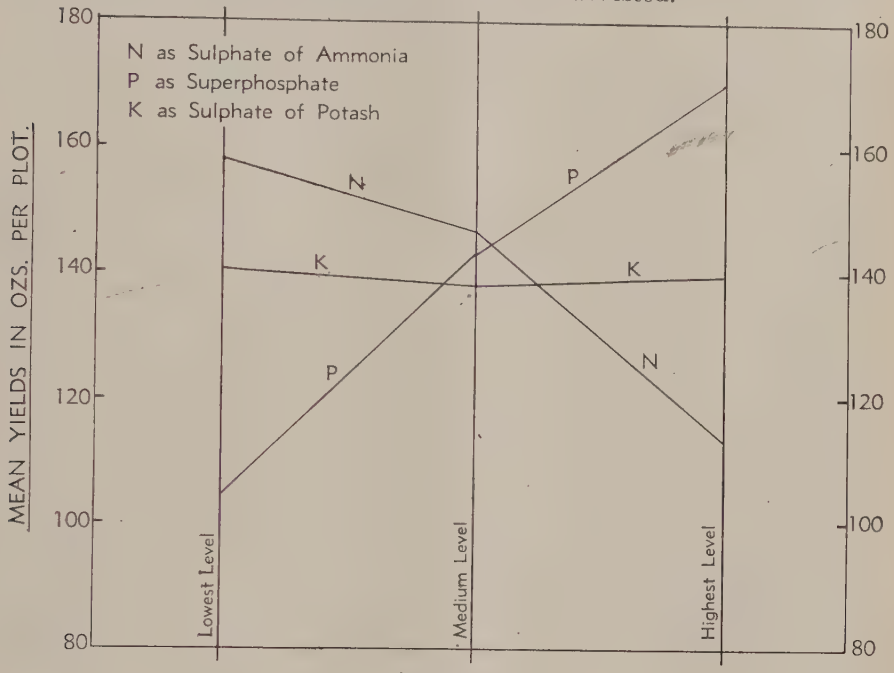

Plate 135.

On the other hand the yield of beans increased as the amount of superphosphate increased and very nearly in proportion thereto. That is to say the yield of beans from the 2-cwt. level of superphosphate was approximately half way between that at the 1-cwt. level and that at the 3-cwt. level. At the moment the maximum effective amount of superphosphate which can be employed has not been determined. Of course the economic value will certainly soon start to lessen, and though further increases may be expected from the increased amounts of superphosphate, it may soon become a question of whether the increase in beans produced will be sufficient to meet the cost of the extra fertilizer applied. An answer to that question should be forthcoming after the next series of trials.

With respect to sulphate of potash, it will be noticed that no benefit can be attributed to its use. The yield of beans at the 1-cwt. level is actually lower than when sulphate of potash was omitted altogether though the difference is not significant. On the information obtained to date the inclusion of this fertilizer in a bean mixture for red basaltic soil is not warranted.

Though it is considered desirable that the Cooroy work be repeated next year, and the view is held that any results from this year's trials at this centre must be viewed with caution, it may be mentioned that in this area also no increase in yield was associated with amounts of sulphate of ammonia above 1 cwt. per acre. However, there was no

depression of yield in those Cooroy plots, on which higher levels of the nitrogenous fertilizer were used, as was the case at Buderim. At Cooroy the higher levels of superphosphate were associated with greater yields, though the results were not so clear cut there as at Buderim.

Sources of Nitrogen.

During the course of this work many growers from time to time have sought information concerning the best source of nitrogen in bean fertilizers. Actually at this stage of the main investigational work the question is not of great moment, though ultimately it will definitely have to be answered. However, this year, in order to get some leads on the matter, a small test was laid down at the Nambour Field Station and three sources of nitrogen were employed. These three—sulphate of ammonia, nitrate of soda, and blood—were each combined with the same mixture of superphosphate and sulphate of potash. On yields, sulphate of ammonia gave the best results, blood was second, and nitrate of soda last. The view has been expressed that blood appears to enable the plants to survive longer and thus perhaps give an extra picking. This may be so, but such a performance would not necessarily be meritorious. It may be better to get the beans off more quickly even if a slightly smaller yield is obtained. Furthermore, the figures obtained this year, in so far as nitrogenous fertilizers are concerned, do not suggest that blood will give the highest obtainable yield. It should be emphasised, however, that this is not a final answer concerning sources of nitrogen and more detailed work may lead to a different conclusion. It must be remembered that during this year the work for the most part was carried on under drought conditions.

Fertilizer Placement.

It was not possible to carry out any extensive experiments on the placement of fertilizers, but one small experiment was carried through successfully. In this, the fertilizer was applied in four different ways—viz., broadcast about ten days before planting, placed 4 inches to the side and slightly below the seed at planting, placed 4 inches to the side and slightly below the level of the seed soon after germination, and placed 2 inches directly beneath the seed at planting. These plots were replicated six times and were spray-watered as required throughout their growing period. In spite of the very adverse weather conditions, including the incidence of abnormally heavy frosts, fair yields were obtained and, on the figures, the method of fertilizing in the furrow below the seed at planting was outstandingly the most successful. The result was so definite that there appears no necessity to repeat the work.

Recommendations.

Although there is still a great deal to be learned concerning the fertilizing of beans, some of the information which has been obtained can be safely applied at least for the time being. Thus a nitrogenous fertilizer is required, but the amount of this should not exceed the equivalent of 1 cwt. of sulphate of ammonia per acre. Superphosphate is even more definitely necessary, but the maximum economic ration of this fertilizer is not yet known. Amounts up to 3 cwt. per acre can be confidently expected to increase yields, and the indications are that appreciably more than that quantity will be found beneficial. The position with respect to potash is still a little obscure in the case of

some soils, but so far there is no evidence which can be taken as suggesting that its inclusion in a bean fertilizer is warranted. Certainly the amount used should be very small. The placement of fertilizer experiment needs no amplification; the fertilizer is best applied directly below the seed at the time of planting and not more than 4 nor less than 2 inches beneath the seed.

RISKS OF TOO-DEEP PLOUGHING.

There is plenty of evidence to show that many growers, particularly those farming the acid-alluvial soils, are ploughing too deeply when preparing the land for planting, in the Innisfail-Tully district.

In most fallow fields an abundance of raw sub-soil is apparent on the surface, and mixed with the fertile surface soil. Where this has occurred, decreased crop yields will necessarily follow and corrective measures will be slow and costly.

While it is desirable to have a deep, fertile soil the process of deepening should be done gradually, and not more than $\frac{1}{2}$ inch to 1 inch of the sub-soil ploughed up during each crop rotation. More attention should be paid to depth of furrow when ploughing, and if much sub-soil is being disturbed the plough should be lifted until a minimum is being brought up.

It might be argued, in some cases, that unless the plough is kept at a depth at which much sub-soil is brought up it is not possible to obtain a deep, friable seed-bed in which to plant the sett. In these circumstances it would be much better to keep the plough at a safe depth and create a deep, friable seed-bed by grubbing deeply prior to planting, or sub-soiling when ploughing, and in this manner improve the depth of tillable soil.

—H.G.K., in *The Cane Growers' Quarterly Bulletin.*

SOIL EROSION—THE HIGH COST OF DOING NOTHING.

Nations and national cultures have died of soil erosion, and if we do not look out, that will be our fate, too.

"The Greeks grew rich and their culture was in flower while their soil was slipping under their feet. It seems unlikely that the bare, rocky hills of Greece could to-day support a culture that would compare with the past." And so also of Palestine, North Africa, parts of Italy; and even in England and Scotland; and in China and Peru, the world is moth-eaten by man. Through it all runs the old story of terracing and careful farming ruined by wars, by greed, and by every force of human stupidity.

In dealing with the problem of soil erosion, a country may easily die of economy—that is, when land and money meet in a head-on collision. The cost of soil conservation may sound tremendous—that is, the cost of doing *something*; but the cost of doing *nothing* is certainly stupendous.

Introduced Legumes in North Queensland.

J. LEEMING SCHOFIELD, Director, Bureau of Tropical Agriculture.

SUMMARY.

A TRIAL carried out at the Bureau of Tropical Agriculture, North Queensland, with numerous legumes comprising temperate, subtropical and tropical types is described.

Results indicate that certain tropical legumes are satisfactory under coastal conditions in North Queensland, but temperate legumes are markedly unsuccessful.

Information on the distribution, characteristics, planting and feeding value of the following tropical legumes is given:—*Stylosanthes guianensis* (Stylo), *Stylosanthes guianensis*, var. *subviscosus* (Hairy Stylo), *Centrosema pubescens* (Centro), *Pueraria phaseoloides* (Puero), *Calopogonium mucunoides* (Calopo), *Cajanus indicus* (Pigeon pea) and *Crotalaria usaramoensis* (Croto).

The possibilities of use of the above tropical legumes for pasture, grassland renovation, green manuring and soil conservation is discussed.

INTRODUCTION.

One of the chief limiting factors to satisfactory grassland development in North Queensland is the lack of suitable legumes. It was considered advisable, therefore, to carry out an extensive trial at the Bureau of Tropical Agriculture to determine which types are satisfactory for commercial practice. Numerous temperate and tropical legumes were selected, and the results are of importance as they indicate quite clearly the class of legume for future study. The trial was situated in the tropical rain forest belt, and the results are not only of value to North Queensland but to Papua, New Guinea, and certain other parts of the Empire within the tropics.

The tropical rain forest of North Queensland lies to the east of the 150 Meyer Ratio isolog, and this area is mentioned by McTaggart as definitely favouring the establishment of exotic plants. Results from the trial indicate the suitability of this belt in North Queensland for the introduction of exotic plants obtained from tropical rather than temperate regions. The work of Davidson, Prescott, and Trumble at the Waite Institute on agroclimatology and bioclimatic zones, using the ratio of mean monthly rainfall to saturation deficit is of considerable value in making comparisons of this nature.

The tropical legumes in the trial have been studied for the possibility of using them for one or more of the following purposes:—(1) Pasture, (2) Grassland Renovation, (3) Green manuring, (4) Soil conservation. Promising types have been selected for each category mentioned above, and experiments are now in progress to determine the economic usefulness of these legumes for the development and closer settlement of one of the richest areas of Australia, namely that of the tropical rain forest of North Queensland.

As pasture forms the mainstay of Australian agriculture, particularly in Queensland, special attention has been given to the selection of

promising legumes for grassland development. During 1939-40 it is estimated that the returns from grassland farming in Queensland, quoting figures recently given by the Premier, Hon. W. Forgan Smith, will approximate to £30,200,000 out of a total of £44,000,000 for the four chief products of the primary industries—wool, meat, butter, and sugar. North Queensland has always been at a disadvantage compared with the southern States, by the lack of a satisfactory pasture legume, and one of the chief objectives, therefore, of this investigation was to select for further and more comprehensive tests, promising pasture legumes.

LEGUME TRIAL.

The trial included 131 types, consisting of tropical, sub-tropical, and temperate legumes; 43 of these legumes, including all the lucernes, were planted with the following treatments in duplicate:—

(1) 1 ton lime, 6 cwt. superphosphate per acre.

(2) 1 ton lime, 4 cwt. superphosphate per acre.

(3) 1 ton lime, 1 cwt. superphosphate per acre.

The remaining legumes were planted on soil which had previously been treated with 3 tons of lime to the acre ploughed under, and a dressing of 4 cwt. of superphosphate was applied prior to planting. The average pH of the soil in this trial before liming varied between 4.5 — 4.8.

Strain is particularly important in a trial of this nature, and accordingly numerous strains were included. The bacteriological aspect of the investigation has received attention, and inoculated and non-inoculated plants have been compared. Experiments with inoculated and non-inoculated seedlings of the various legumes at the Bureau have not resulted in any differences in growth or vigour. There would appear to be no necessity, therefore, for seed inoculation in the several coastal districts so far examined. But investigation on this matter is proceeding, and it is possible that seed inoculation will be required for satisfactory development in certain areas. It is also possible that different strains of *Rhizobium* will be isolated for use under varying soil and climatological conditions.

One general conclusion can be drawn from this trial: temperate legumes are useless under coastal conditions in North Queensland. Twenty-five different types of lucerne, ten species of *Trifolium*, numerous *Lespedeza* species, and other members of the bean family were included, but not one representative of the temperate legumes showed promise in any treatment. By contrast, however, certain tropical legumes achieved considerable success. The growth of these legumes is particularly vigorous. A carpet of thick cover several feet in depth is produced by the creeping legumes which smothers out weeds and acts as an effective guard against soil erosion. These tropical legumes are persistent, they produce dense cover throughout the year, and are capable of withstanding excessive heat, extremely heavy rainfall, and periods of relatively dry weather.

William Davies, of the Welsh Plant Breeding Station, Aberystwyth, in pamphlet No. 39, Council for Scientific and Industrial Research, "The Grasslands of Australia and Some of Their Problems," makes the following statement which deserves special attention: "Concerning the species problem in Queensland pastures, there are two obvious alternatives involving the study of two contrasting sets of

plants. It is desirable to determine in Queensland whether the indigenous or other tropical pasture plants are worth dealing with in detail. Is it worth while, for example, doing plant breeding and selection work upon them, or is it better to concentrate upon temperate plants of recognised value and to find means of building them into swards under tropical conditions?'' Under conditions on the North Queensland coast, this trial indicates that work on tropical legumes is producing results which may be of considerable value for grassland development, should the experiments which are being carried out to determine reaction to grazing and the resultant effect on the animal prove satisfactory.

TROPICAL LEGUMES.

"Stylo" (*Stylosanthes guianensis* Sw.).

Native Habitat and Distribution: A native of the sandy soils of Brazil where it is reported as very valuable for pasture or hay, its nutritive value, being fully equal to that of lucerne; vernacular name "Trifolio." Introduced into Queensland in June, 1933, by the Department of Agriculture and Stock from Brazil and growth at Sarina, Tully, and Innisfail has proved satisfactory. Trials have been laid down on numerous farms along the tropical north coast and the hinterland, to determine the limits of commercial application.

Common Name: For ease of reference this legume has been called "Stylo."

Description: A perennial with trifoliate leaves, each leaflet acute. Small yellow flowers produced at the upper nodes of the stems, each inflorescence having 10-15 flowers; each pod contains a single seed.

Planting: The number of seeds per lb. is approximately 120,000; scarification by grinding with sand or other suitable method should be carried out before planting, as this treatment increases the germination by as much as 40 per cent. Successful plantings can be made using cuttings of 6 inches to 8 inches long containing 4 or more nodes if put out at the commencement of the wet season. Seeding at from 1-4 lb. per acre according to circumstances is suggested.

Feeding Value: High; and in palatability trials this legume has been readily consumed. At South Johnstone, grazing trials alone and in combination with different grasses indicate that in the early stages of growth this legume appears to be rather unpalatable to cattle. This valuable property may prove of great importance, for, when it is considered in combination with its vigorous growth, perennial habit, and ability to produce seed, it simplifies considerably establishment and persistency in widely varied types of grassland.

Uses: This legume is the most promising pasture component to date in North Queensland; it is aggressive and able to withstand successfully heavy rainfall and relatively dry conditions, but initial growth is slow. Stylo flourishes on the red soils of the Innisfail area, particularly on well drained hillsides, it thrives on acid soils, but it is intolerant of swampy conditions. Once established it is capable of spreading by means of its free-seeding habit, even when in competition with weeds and inferior grasses. Stylo shows great promise as a pasture legume of high value, suitable to the tropical conditions of North Queensland, and deserves widespread trial.

"**Hairy Stylo**" (*Stylosanthes guianensis* Sw. var. *subviscosus*).

Native Habitat and Distribution: Native to Brazil, vernacular name "Meladinho;" recently introduced into Australia by the Council for Scientific and Industrial Research.

Plate 136.

ILLUSTRATING THE ASSOCIATED GROWTH OF STYLO AND BRACHIARIA DECUMBENS IN A GRAZING EXPERIMENT; FIVE MONTHS OLD, GROWN ON SUGAR-CANE LAND AT THE BUREAU OF TROPICAL AGRICULTURE.

Common Name: For ease of reference, this legume has been called "Hairy Stylo."

Description: Closely related to the preceding species but distinguished by its lighter-coloured, narrower, and smaller leaves and sticky exudation from the hairs. A valuable fodder plant with a yield slightly lower than Stylo. The initial growth is particularly good on the North Queensland coast.

The above two legumes are quite distinct from Townsville lucerne, *Stylosanthes sundaica* Taub. (syn. *S. mucronata* Willd.). This latter species is a summer-growing, self-regenerating annual; it is much smaller and does not possess the vigour and body of Stylo. Under low rainfall conditions, however, and on soils of low fertility, Townsville lucerne is a most useful legume.

"**Centro**" (*Centrosema pubescens* Benth).

Native Habitat and Distribution: Native to South America, but found wild in Java in 1921; used extensively as a cover crop in the East; introduced into Australia by the Council for Scientific and Industrial Research.

Common Name: For ease of reference, this legume has been called "Centro."

Description: A perennial twining herb with trifoliate leaves forming a compact cover over the ground about 1½ feet deep. It is aggressive and hardy although initial growth is rather slow. Climbs readily and is an effective weed-smother crop; it will thrive under shade. The pods are 5-6 inches long, flat in appearance, and contain up to 20 seeds.

Effective Life: Will continue to thrive for many years in the East if the soil is sufficiently fertile; under conditions on the North Queensland coast growth is good, even during winter. Prolific flower and seed production occurs, to a much greater extent than in the East, and thus under natural conditions a rapid spread of this legume is assured.

Palatability: Good; tests are in progress on the grazing of Centro alone and in combination with various grasses.

Planting: The number of seeds per lb. is approximately 15,000. Seeding at the rate of 5-6 lb. per acre is suggested.

Plate 137.

A Crop of Centro Five Months Old, illustrating the Dense Cover Formed nearly 1 foot in depth, Grown on Sugar-cane Land at the Bureau of Tropical Agriculture.

"Puero" (*Pueraria phascoloides* Benth; syn. *P. javanica* Benth.).

Native Habitat and Distribution: Indigenous to Malaysia, used extensively as a cover crop in the East; introduced into Queensland in October, 1933, by the Department of Agriculture and Stock from the Department of Agriculture, Peradeniya, Ceylon.

Common Name: For ease of reference, this legume has been called "Puero."

Description: A vigorous perennial twining herb often producing primary runners more than 30 feet long with numerous secondary shoots; forms a dense cover about 2-3 feet deep. Leaves large, trifoliate, hairy. Flowers in scattered pairs in racemes; mauve in colour. The pods are 3-4 inches long, rather cylindrical in shape and contain

approximately 18 seeds. Seeds small, brown in colour. As a weed-smother crop this aggressive legume is unsurpassed, but initial growth is rather slow. Climbs readily, and will grow under shade.

Effective Life: Continues to thrive for many years in the East on fertile soils. Growth on the North Queensland coast is good, even during the winter, flowering occurs and seed is set readily under satisfactory conditions, whereas in Malaya it is a rather shy flower producer.

Palatability: Taken readily by cattle; grazing trials alone and in combination with various grasses are now in progress. In a recent grazing trial at the Bureau, Puero was eaten with relish.

Planting: The number of seeds per lb. is approximately 37,000. Seeding at the rate of 3-4 lb. per acre is suggested, or planting cuttings 2-3 feet long, two per point 4 feet by 4 feet.

Plate 138.

A Crop of Puero Five Months Old, demonstrating the Strongly Aggressive Nature of the Legume; the Dense Cover is 2 feet deep, Grown on Sugar-cane Land at the Bureau of Tropical Agriculture.

"Calopo" (*Calopogonium mucunoides* Desv.).

Native Habitat and Distribution: A native of tropical America, introduced to the East as a cover crop. Seed obtained in Australia through the Council for Scientific and Industrial Research.

Common Name: For ease of reference, this legume has been called "Calopo."

Description: A vigorous aggressive creeping herb forming a dense mat of foliage 1-2 feet deep of trifoliate hairy leaves. Flowers produced in short racemes, small, pale blue in colour. Climbs readily but will not thrive under shade. It is a valuable cover for newly-cleared land where it is not intended to sow it immediately to grass; it develops quickly and soon covers the ground. Not so hardy as Puero and Centro, but the rapid initial growth of Calopo makes it a desirable legume for

mixing with these two covers which develop more slowly. On cultivated land, however, Puero alone is preferable, as Calopo and Centro produce seed freely.

Effective Life: In the open this cover will persist for many years as seed production is profuse and natural regeneration occurs. Under shade, however, Calopo soon disappears. It is not so hardy as Puero and Centro.

Palatability: Trials indicate that although not eaten with relish it is not unpalatable.

Planting: The number of seeds per lb. is approximately 33,000. Seeding at the rate of 3-4 lb. per acre is suggested.

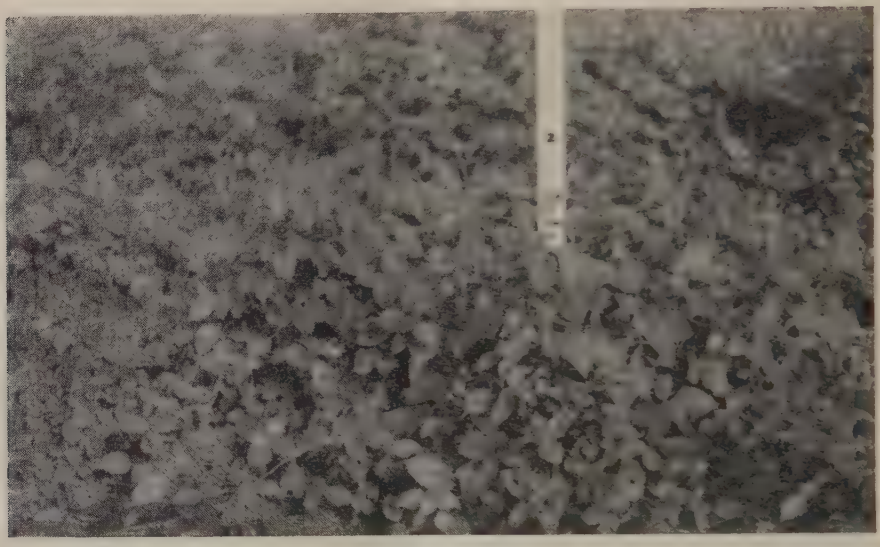

Plate 139.

A Crop of Calopo Ten Months Old, showing the Thick Cover over 1 foot in depth, Grown on Sugar-cane Land at the Bureau of Tropical Agriculture.

Pigeon Pea (*Cajanus indicus* Spreng; syn. *Cajanus cajan* Linn.).

Native Habitat and Distribution: Indigenous to India, Burma, West Indies, Tropical Africa, New Guinea, and Malaya. Widely distributed throughout the tropical belt.

Description: An upright shrub 6-8 feet high with narrow trifoliate leaves and thin branches. Flowers small, usually yellow but in certain forms the dorsal side of the standard is dark red; the pods vary in length from 2-5 inches. Many new strains of this legume have been produced in Hawaii where it is used for cattle fattening and as a green manure. This useful plant grows well under North Queensland conditions, and promises to be a valuable legume for stock feeding and a satisfactory green manure; it possesses a large tap root which is useful in opening up the soil. Although this long-established legume has not proved popular in the southern part of the State, it is well worthy of trial in North Queensland as an edible mineral-efficient legume sown in strips across pastures, a technique advocated—using appropriate plants—by that great exponent of grassland development, Sir R. G. Stapledon.

Effective Life: Depends on the strain; with systematic pruning or feeding off, the crop may last from 15 months to 5 years.

Planting: A rate of 5 lb. seed per acre is suggested.

General: The pigeon pea is a crop which deserves the attention of farmers on the tropical north coast, it is a useful stock feed and an excellent green manure. Yields up to 35 tons per acre equivalent to 500 lb. nitrogen per acre have been obtained for green manuring. The dried split peas are an excellent article of diet, and contain more protein and fat than either soybeans or alfalfa; the average yield of cleaned peas per acre is from 500 to 1,000 lb.

Plate 140.
AN AVERAGE CROP OF PIGEON PEA EIGHT MONTHS OLD GROWN ON SUGAR-CANE LAND AT THE BUREAU OF TROPICAL AGRICULTURE.

"**Croto**." (*Crotalaria usaramoensis*).

Native Habitat and Distribution: Indigenous to tropical East Africa, successfully introduced in British Honduras, Burma, Ceylon, Malaya, North Borneo, and the Dutch East Indies.

Common Name: For ease of reference, this legume has been called "Croto."

Description: A large erect shrub 9-12 feet high with a free branching habit, rather similar to *C. anagyroides*, but differs in possessing smaller flowers, deflexed pods and it does not produce woody growth to the same extent.

Effective Life: Approximately 18 months to 2 years, it can withstand pruning and thrives on a wide variety of soils. Growth in the wet belt of the North Queensland coast is particularly good, a height of 10 feet being attained; seed is produced freely.

Planting: The number of seeds per lb. is approximately 127,000 (compare *C. anagyroides* at 24,000 to the lb.). Seeding at 5 lb. per acre is suggested for row planting, but if broadcast, a considerably higher rate should be used.

TROPICAL LEGUMES FOR PASTURE PURPOSES.

Very little is known concerning the possibility of using tropical legumes for pasture. Palatability tests have been conducted, and grazing trials are now in progress, using Stylo mixed with various grasses. Grazing experiments with Stylo, Calopo, Centro, and Puero alone, and in combination with different grasses have been laid down to determine the effect of continued grazing on the legume and on the animal. The development, habit and free seeding nature of these tropical legumes show promise for pasture work and the above experiments will determine whether they can be utilised successfully.

When it is realised that several experiment stations have shown that dairy and beef products may be produced on practically an entire grass and legume ration at a considerably greater profit than on more concentrated rations, the importance of finding satisfactory tropical legumes for pasture purposes can be visualised. At the Middle Tennessee Experiment Station, finished beef is being produced on an all-year pasture-hay ration (with only a small addition of cotton-seed meal) at a considerable profit over the usual pasture-grain feeding. There are thus great opportunities on the Queensland tropical north coast for beef production using improved grasses and tropical legumes.

TROPICAL LEGUMES FOR GRASSLAND RENOVATION.

An experiment on weed control using Puero as a smother crop was commenced at the Bureau in 1939. Planted at 8 feet by 8 feet, Puero produced an effective check on weed growth, and at 4 lb. per acre the thick mat of leguminous cover effectively repressed all weeds. Calopo also has proved satisfactory in this respect, and its quick growth makes it an excellent cover to mix with the aggressive, but rather slow growing Puero; as, however, Calopo seeds very freely, care should be taken not to employ this cover on cultivated land as a long-period green manure. The aggressive nature of these tropical legumes, combined with their perennial habit, indicate that they may be used for grassland renovation and careful attention is being given to this matter.

TROPICAL LEGUMES AS GREEN MANURES.

The tropical legumes mentioned have not as yet been used as green manures under North Queensland conditions, but the evidence obtained from the trials conducted at South Johnstone indicate their value as short and long-period cover crops. These legumes can be divided into two categories namely, upright and creeping cover crops.

(*a*) *Upright Green Manures.*—The pigeon pea is a good example of this type. It produces a heavy bulk of easily decomposable vegetable matter, and it can be used for stock feeding if required. Ploughing under presents no difficulties, and if desired it can be ratooned and a second and third crop obtained. Croto is another example of a promising upright green manure.

(*b*) *Creeping Green Manures.*—Puero shows promise for a long-period green manure. Calopo may be of value as a short-period cover, and further investigation is being undertaken on this matter. Judging from the results obtained in the trials at South Johnstone, these tropical creeping legumes may be of considerable value in raising fertility and improving soil texture under North Queensland conditions.

TROPICAL LEGUMES USED FOR SOIL CONSERVATION.

In Malaya, Calopo, Centro, and Puero are used to prevent soil erosion, particularly the two latter covers. The vigorous growth exhibited by the above legumes under coastal conditions in North Queensland indicates that they may also be of considerable value for soil conservation in this area, when used in conjunction with up-to-date methods, and the possibilities of economic use are being investigated.

DISCUSSION.

The promising creeping tropical legumes Calopo, Centro, and Puero are new to North Queensland, but they are used extensively in Ceylon, Java, Malaya, and Sumatra as plantation cover crops. It is interesting and instructive, therefore, to compare and contrast the climatic differences existing between say, Malaya, and the portion of North Queensland to which this experiment refers. In both areas the climax vegetation is tropical rain forest with its mixed botanical composition, although Malaya is situated north of the equator between 1 degree and 6 degrees latitude, and the main portion of North Queensland lies south of 15 degrees latitude (south). The climate of North Queensland is fundamentally different to that of Malaya in two important particulars: it possesses a winter season, and a prolonged period of wet weather. Malaya by comparison has no winter, the rainfall is more evenly distributed, and the temperature range is much smaller. In Malaya, the total annual rainfall varies from 88 inches to 140 inches, depending on the locality, while on the North Queensland coast, the precipitation ranges from 60 inches to 160 inches. The mean minimum and maximum temperature for twelve months in Malaya is from 70 degrees to 90 degrees F., and is practically uniform throughout the year. On the North Queensland coast, however, the figures approximate to 65 degrees to 82 degrees F. with a marked seasonal variation, the mean minimum monthly temperature being as low as 13 degrees F. below the corresponding figure for Malaya. This seasonal variation in North Queensland, with the accompanying difference in length of day, serves as a great stimulus to flower production in tropical legumes, which results in greatly enhanced yields of seed as compared with the same legumes under Malayan conditions. In Malaya, for example, Puero rarely sets seed, but by virtue of its vigorous vegetative habit this aggressive perennial forms a dense cover. Under North Queensland conditions, Puero assumes an added significance, for in addition to its vigorous vegetative growth, seed production also occurs under suitable conditions. This seeding habit in a perennial, which possesses great power of spreading vegetatively by means of rooting along the runners, provides a legume which offers great possibilities as a long-period cover. Seeding occurs to a much greater extent with Calopo and Centro, and although in Malaya these two legumes seed freely, seed production in North Queensland is much heavier. It would appear, therefore, that these tropical legumes may be of even greater value under conditions in North Queensland than in Malaya. Stylo has not been grown in the East to my knowledge to-date, but in North Queensland the possibilities of use for pasture purposes are most promising. It thrives under a wide range of conditions, and grazing tests with it alone and in combination with selected grasses are in progress.

A factor of considerable importance in these investigations with tropical legumes is that they thrive on acid soils. This fact provides the farmer with an urgent necessity in many areas of North Queensland, namely legumes for soils with an acid reaction.

ACKNOWLEDGEMENTS.

The author's thanks are due to officers of the Council for Scientific and Industrial Research for supplying seed of numerous legumes; to Mr. C. R. Mulhearn, Director of the Animal Health Station, Oonoonba, for the conduct of palatability trials on numerous tropical legumes: and to Mr. J. Hart for assistance with the experiments.

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Plate 141.

THE "CRADLE" OF THE AUSTRALIAN WHEAT INDUSTRY.—"Experiment Cottage," the Parramatta home of James Ruse, who planted in its grounds the first wheat grown in Australia.

Poultry Farming in Queensland.

(*Continued from page* 331, *October*, 1941.)

THE FEEDING OF CHICKENS.

In the feeding of chickens it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as just prior to hatching the balance of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least forty-eight hours to elapse before feeding. Chickens fed earlier are subject to bowel trouble. If, however, feed is withheld after the forty-eight hours, weakness develops, from which many chickens will not recover.

Requirements of Growth.

Chickens make very rapid growth in the early part of their life. This development is most rapid during the first six to eight weeks, consequently rations having a relatively high protein content are necessary to give the best development. From experimentation it has been established that rations having a crude protein content of 18 to 20 per cent. should be used during the first six to eight weeks, and after that period this should be reduced to 15 per cent. The protein requirement of a chicken does not alter as sharply as this, but these periods and protein content are suggested as meeting the practical requirements of the poultry-raiser.

The practice adopted by many poultrymen of reducing the protein content of a ration after the chickens are about sixteen weeks of age in order to delay sexual development is desirable if the birds are maturing too rapidly. Development, however, can be controlled to only a very limited degree, and the danger of under-feeding protein must be avoided. On the other hand, excessive protein feeding must be guarded against, as the over-feeding of protein-rich foods causes deposits of urates in the ureter, kidneys, and other organs, and may place an undue strain upon the liver.

It is generally conceded that milk is the most desirable protein feed for chickens and growing stock, but owing to its cost its exclusive use is not always possible. Wherever possible milk should form a portion of the ration. It may be given in the form of curds, semi-solid milk, butter-milk, or butter-milk powder. As a drink, milk is excellent, but it is objectionable because of the difficulty of keeping chickens clean. Butter-milk powder is favoured because of the ease with which the powder may be incorporated in the mash, thereby controlling the kind of food that each chicken consumes. Apart from its concentration, however, it has no definite advantage from a feeding value point of view. Proteins build flesh, but at the same time a bony framework is necessary. Analysis of the chicken at different ages, according to Halnan, indicates that it is particularly important to allow for the mineral requirements from the eleventh to the twenty-fourth week. In all experiments conducted by this Department, provision has been made for increased mineral intake by the addition of bonemeal to the mash at eight weeks of age, and by allowing the birds free access to grit (shell and hard).

The following table showing the food consumption of chickens has been compiled as a result of actual experiments conducted in this State, the ration used being as set out in Table III.:—

TABLE II.

Food Consumption of Chickens.

Age.	Leghorns.		Australorps.	
	Weight of Chickens.	Food Consumed Weekly.	Weight of Chickens.	Food Consumed Weekly.
	Oz.	Oz.	Oz.	Oz.
Day old	1·3	..	1·36	..
1 week	1·97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5·84	5·05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8·96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20·41	13·29	25·31	15·05

The variation in weight from week to week and the ever-increasing amount of food required suggest the undesirability of laying down hard and fast rules as to what quantity should be supplied.

The food requirements increase week by week, and a system of feeding which enables the growing birds to consume all they require is the most desirable.

By reason of the fact that the kind of food consumed is easily controlled, and that it is always in front of the birds, the all-mash system of feeding chickens is suggested as being the most desirable. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. Trays of a depth of 2 inches should then be used, and by the end of the first week narrow trays or troughs 4 inches deep should replace these. At this age chickens will commence to scratch with more vigour, scattering the feed from the trough. This can be prevented by placing a piece of netting on top of the mash loose enough to sink as consumption takes place. During the first week 8 lineal feet of feeding space should be allowed for every 100 chickens, and later increased to 12 feet. Prior to the mash being covered with netting it is important that only a little food at frequent intervals be placed in the trays in order to avoid wastage.

In fact, the frequent feeding of all-mash appears to induce greater food consumption and better development.

Breeders who do not desire to feed an all-mash may make use of commercial chick grains and growing mashes which may be fed as directed by the manufacturers. It has been the custom for many poultry raisers to use scratch grain only for a short period of a chicken's life, but in view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than is usually contained in chick mixtures, early mash feeding appears essential.

Chickens may be reared satisfactorily upon moistened mashes and grain from about two weeks of age, but the mashes must be fed at frequent intervals. This system offers the advantage of utilising milk when available, as a medium of moistening the mash. The feeding of dry mash, however, is suggested as a safer method, as the possibility of food becoming sour and the probable consequent bowel trouble among chickens is avoided.

Suitable All-Mash Mixture.

The following mashes have been used successfully in experiments conducted by the Department, and are suggested as a basis upon which to work. At times it may not be commercially sound to adhere rigidly to the ingredients suggested, but from the table of analyses supplied it will be possible for the breeder to compound other suitable mixtures.

TABLE III.

—	1 to 8 Weeks.	8 Weeks to Maturity.
	Per cent.	Per cent.
Maize meal	40	60
Bran	20	13½
Pollard	20	13½
Meat and bone meal (63% protein)	7½	5
Dried buttermilk powder	10½	3½
Salt	1	1
Cod liver oil	1	1
Lucerne meal	..	2½

CARE OF MOULTING HEN.

It is a common practice among breeders to give little attention to moulting birds. In many instances they receive nothing but a grain ration. Feathers contain a considerable amount of protein, and the most economical manner of getting birds back into production is to feed protein-rich foods as provided in a laying ration. Moulting may be induced by the feeding of nothing but grain at or about the time birds usually moult. When once the moult has commenced laying rations should be supplied, as it will take about a fortnight for the manufacture of the first egg after the moult is completed.

FATTENING.

Two classes of birds have to be considered—old hens and cockerels. The ability of the feeder to do much with old hens in good condition is questionable, but those slightly out of condition may be improved with ten to fourteen days' crate feeding. From experiments it has been found economical to rear cockerels to the various marketing stages on the growing rations used for pullets. Ten to fourteen days of crate feeding for these birds would undoubtedly add to their market value. Old hens or young cockerels should be freed of external and internal parasites before being submitted to a fattening process. The crates could be small coops 2 feet wide, 3 feet deep, and 3 feet high. These crates hold about six birds, and if the floor is of wire-netting and above ground level the droppings will fall through and the birds will be kept clean. The front should be of wire or slats wide enough apart for the birds to get their heads through to feed from a trough in the front. An all-mash mixture of a relatively high protein content fed as a gruel three times a day will undoubtedly improve condition. With this system of feeding water is not necessary. Any food remaining after half-an hour should be removed in order to keep the appetite keen. A mash of equal parts maize meal and pollard, plus 10 per cent. buttermilk powder and 5 per cent. meat meal, is suggested.

MIXING OF MASHES.

On the majority of farms the various ingredients of a mash are either mixed with a shovel upon the floor of the feed room or in a trough.

If the mash is to be fed wet it is a good practice to soak the lucerne chaff or meal in water. Just sufficient water should be used to bring the mash to the correct consistency. The salt used in the mixture should be dissolved in the water first. This ensures equal distribution.

In making a dry mixture the salt should be added to the protein-rich foods in order to increase the bulk through which the salt is distributed.

When using cod or other fish liver oil, an equal distribution is ensured by first incorporating it in the bran.

Much labour will be saved and better mixing of the various ingredients ensured by using a mash mixer. An appliance that serves the purpose is easily constructed by the poultry raiser. The mixer consists of a drum constructed of 22-gauge galvanised sheet iron with tongued and grooved pine ends, as illustrated in Plate 142. A pipe of

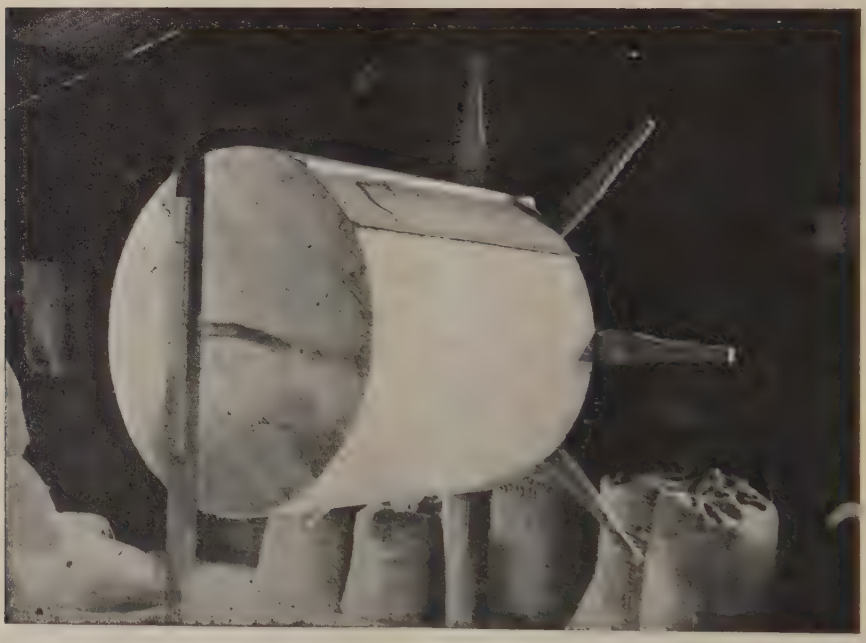


Plate 142.
A Handy Mash Mixer.

1¼-inch diameter is passed through the centre of the drum, fitting into hardwood bearings at each end. This pipe can be keyed to the drum by boring a hole through the pipe close to the drum and using a piece of No. 8 wire as a key. The No. 8 wire must be bolted to the drum.

The mash is mixed by a tumbling process, and to assist in raising the mash on the side of the drum while it is revolving, four battens should be attached lengthwise inside the drum 2 inches from the iron. The battens should be of 2½ by 1-inch timber.

The diameter of the drum is 3 feet 6 inches, and the length equal to the width of the iron. The sheet iron to pass around the drum must be riveted end to end, and the sides attached to the pine ends every 2 inches with screws. A convenient sized opening, the full length of the drum, must be left for filling. A sliding close-fitting door must be provided.

FEED HOPPERS.

Hoppers constructed to permit of ready access to the mash by the birds without food wastage are essential for efficient and economic feeding. Self-feeding hoppers which hold a large quantity of food are in general use, and they possess the advantage of economy in labour, as frequent distribution of mash is not necessary, but if these hoppers are not correctly made much feed wastage takes place. They are only suited to the feeding of dry mash. Frequent inspection is essential, as the mash sometimes clogs, and the hopper must be tapped to dislodge it.

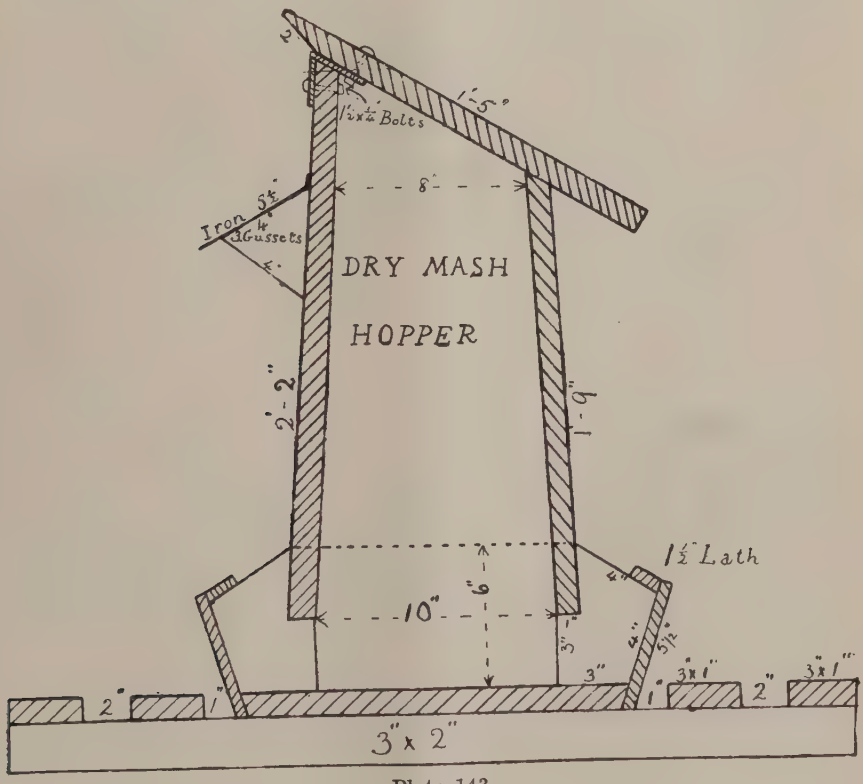
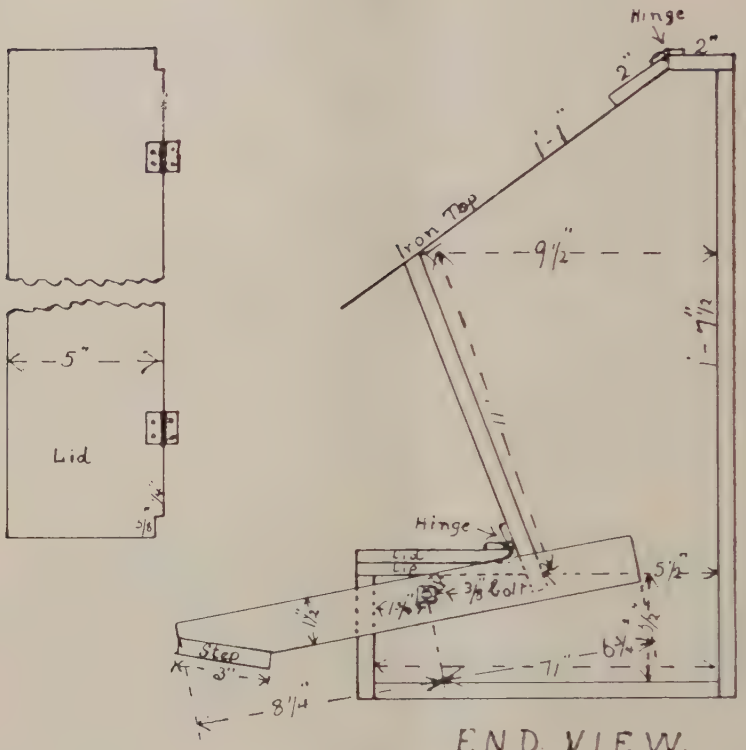
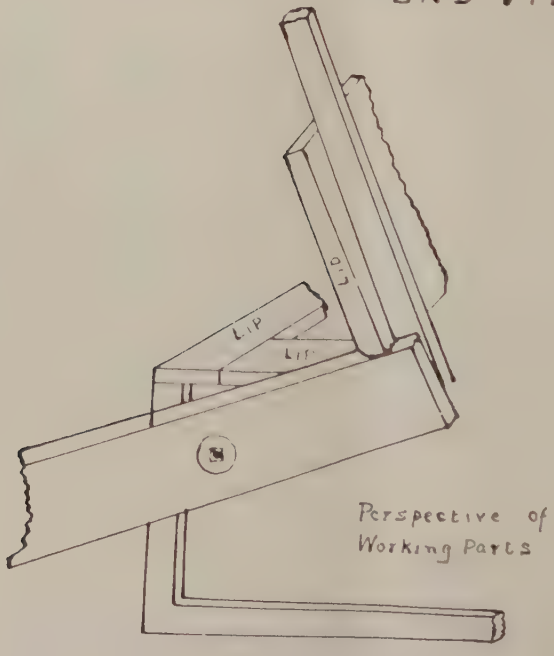


Plate 143.

A Double-sided Self-feeding Hopper.

The trough type of hopper is suitable for the feeding of both wet and dry mash as well as green feed. Only sufficient feed should be distributed to last the birds one or two days. Fresh mash appears more appetising to the birds, resulting in greater consumption and production. It is also possible from a casual inspection to determine whether





J. J. McL.

Plate 144.

PLAN OF AUTOMATIC FEEDING HOPPER.

the supply of food requires replenishing. The birds should be allowed to consume all the dry mash in the trough at least once per week to ensure that fresh mash is not being placed continually on the top of the stale.

When dry mash is being fed, 1 foot of hopper space should be allowed for every ten birds. When feeding wet mash, sufficient space should be provided to permit of all birds feeding at the same time, as the mash should be consumed before it dries out or spoils.

Plate 143 illustrates a double-sided self-feeding hopper that has proved very efficient. Plate 144, a self-feeder that automatically shuts off the mash when the bird leaves the hopper. Plates 145 and 146 illustrate a trough hopper with a reel over the centre. As small birds are able to gain entrance to the trough between the reel and side, smaller-sized hoppers are required for growing stock. Plates 147 and 148 illustrate a trough hopper with a slatted top. These slats, to some extent, reduce the feeding space, but they prevent food spoilage and wastage. Hoppers may be made to any length, but it is a good plan to restrict the length in order that one person can readily move an empty hopper. Trough hoppers 4 feet in length are suggested as the maximum, and the double-sided self-feeding hopper should be no longer than 3 feet.

GREEN FEED.

Green feed has long been recognised as an important food for poultry, and fowls of all ages relish it. It is relatively rich in vitamin A and has some feeding value apart from its protein and mineral content. If green feed is used in a wet mash the amount of green feed consumed is increased. It is probably one of the best means of adding bulk to the ration. Its use also improves the hatchability of eggs and the development of growing stock. The young, tender growing portions are the most valuable.

The quantity used depends upon supplies and general conditions. When fed by itself at midday, the birds should be given as much as they will consume, and when incorporated in the mash it may constitute 25 per cent. of the bulk of the mash. The green feed should be placed in hoppers and not thrown indiscriminately about the pens. During droughty periods, when poultry foods have been costly, green feed has been used with success to the extent of 60 per cent. of the bulk of the mash supplied, but as it is not highly nutritious and carries a good deal of moisture, the birds are unable to consume sufficient quantities in one feed, and two feeds of mash containing 60 per cent. should be given during the day with a full evening feed of grain.

As green feed is most suited to poultry when fed in the young succulent stage, a regular supply is only possible with some form of irrigation. The economic installation of an irrigation system is a problem that is best solved by individual producers. Where it is impossible to employ irrigation owing to the cost of plant or the inability to obtain a good supply of suitable water, and where the seasons are against the growing of green feed, substitutes in the form of lucerne chaff or silage are recommended.

Lucerne is probably the best crop to grow where soil and climatic conditions or irrigation facilities permit, as it is rich in protein, succulent, easily handled, and responds to repeated cuttings.

Plate 145.
TROUGH FEED HOPPER WITH ROLLER TOP.

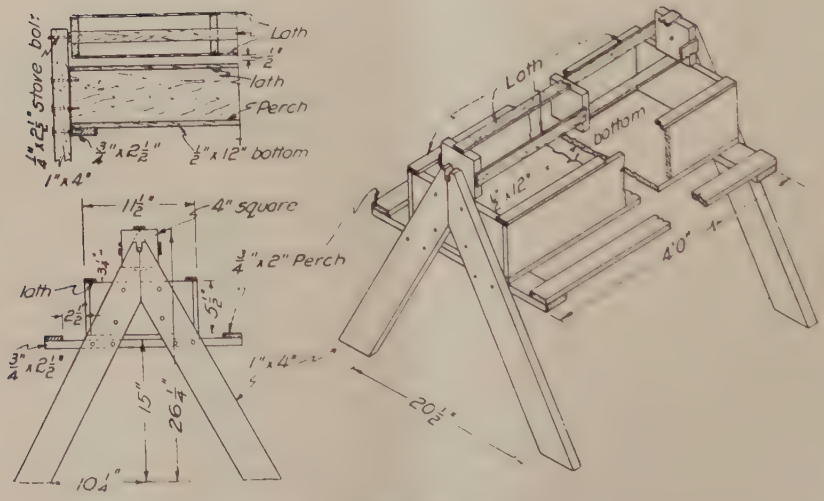


Plate 146.
PLAN FOR THE CONSTRUCTION OF TROUGH HOPPER SHOWN IN PLATE.

Plate 147.

TROUGH FEED HOPPER WITH SLATTED TOP.

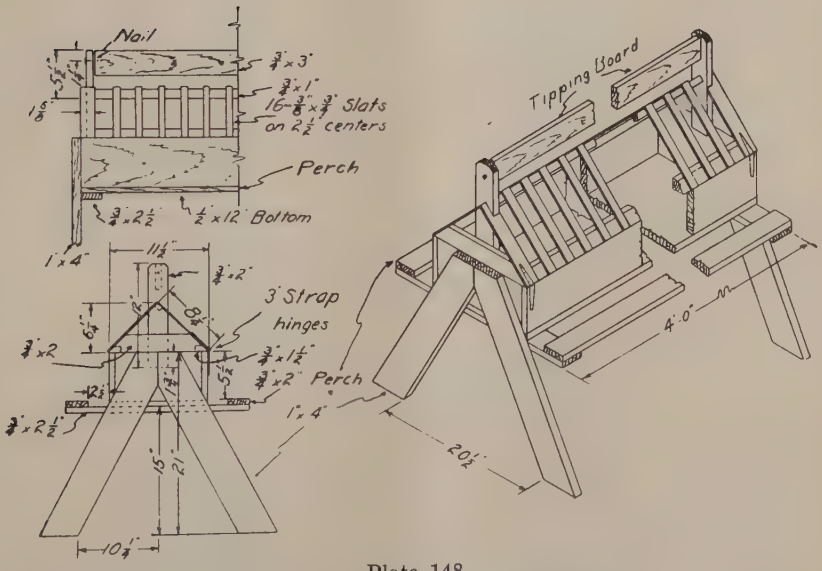


Plate 148.

PLAN FOR THE CONSTRUCTION OF TROUGH HOPPER SHOWN IN PLATE.

In districts where lucerne cannot be grown successfully, the finer-stemmed varieties of cowpea (summer) and the field pea (winter) will provide a useful substitute.

The millets, which include Japanese, white panicum, and giant panicum, provide a useful summer crop. They are early maturing, nutritious, and reasonably fine stemmed. Because of their habit of quick growth, however, succession sowings of millets are necessary to provide succulent feed over the summer season.

Young maize is also valuable, but this crop rapidly becomes coarse.

The winter cereals—wheat, oats, barley, &c.—are particularly useful in season, and will provide excellent feed over a long period. Rape is also suitable for autumn sowing and may be fed to poultry without chaffing.

Although grasses are primarily suitable for open range, succulent grasses, such as kikuyu and paspalum (sown from December to February) and rye and prairie (sown late March to May) will provide cuttings of nutritious, easily-handled green food.

TABLE IV.

POULTRYMEN'S CALENDAR FOR GROWING GREEN FEED.

Month.	What to Sow.	Ready to Cut in Approximately—	For Use in—
		Weeks.	
January	Millet	3	January–February
	Buckwheat	3	January–February
	Poona Pea	4	February–March
	Kikuyu Grass ..	8	All year in frost-free areas
	Paspalum Grass ..	8	All year in frost-free areas
February	Millet	3	February–March
	Buckwheat	3	February–March
	Poona Pea	4	March–April
	Kikuyu Grass ..	8	All year in frost-free areas
	Paspalum Grass ..	8	All year in frost-free areas
March	Oats	3–4	April–May
	Barley	3–4	April–May
	Wheat	3–4	April–May
	Rape	4	April–June
	Field Peas	4	April–July
	Italian Rye Grass ..	5	May–November
	Wimmera Rye Grass	5	May–November
	Prairie Grass ..	5	May–November
	Chinese Cabbage ..	..	..
April	Oats	3–4	May–August
	Barley	3–4	May–August
	Wheat	3–4	May–August
	Rape	4	May–July
	Field Peas	4	May–July
	Lucerne	4–6	All year round
	Italian Rye Grass ..	5	May–November
	Wimmera Rye Grass	5	May–November
	Prairie Grass ..	5	May–November
	Chinese Cabbage ..	..	..

TABLE IV.—*continued.*

POULTRYMEN'S CALENDAR FOR GROWING GREEN FEED—*continued.*

Month.	What to Sow.	Ready to Cut in Approximately—	For Use in—
		Weeks	
May	Oats	3–4	June–August
	Barley	3–4	June–August
	Wheat	3–4	June–August
	Rape	4	June–August
	Field Peas	4	June–August
	Lucerne	4–6	All year round
	Italian Rye Grass	5	May–November
	Wimmera Rye Grass	5	May–November
	Prairie Grass	5	May–November
	Chinese Cabbage	..	..
June	Oats	3–4	July–September
	Barley	3–4	July–September
	Wheat	3–4	July–September
	Field Peas	4	July–September
	Chinese Cabbage	..	..
July	Oats	3–4	August–October
	Wheat	3–4	August–October
	Barley	3–4	August–October
	Field Peas	4	August–September
	Canary Seed	4	August–September
	Chinese Cabbage	..	..
August	Millet	3	August–September
	Canary Seed	4	September–November
September	Millet	3	September–October
	Buckwheat	3	September–October
October	Millet	3	October–November
	Buckwheat	3	October–November
November	Millet	3	November–December
	Buckwheat	3	November–December
	Poona Pea	4	December–January
December	Millet	3	December–January
	Buckwheat	3	December–January
	Poona Pea	4	January–February
	Kikuyu Grass	8	All year in frost-free areas
	Paspalum Grass	8	All year in frost-free areas

GREEN FEED SUBSTITUTES.

Lucerne Chaff.

Lucerne chaff has been found an excellent substitute for green feed. It possesses most of the qualities of good green feed, being a relatively valuable source of vitamin A and minerals and containing some vitamin D. All lucerne chaff has not the same value, and the choicest lines are the most desirable for use in the feeding of poultry. Leafy lucerne of a good green colour is a good source of vitamin A, whilst lucerne that is bleached contains virtually none. The important factor of fibre

content, together with the protein value, is illustrated in the following analyses:—

	Protein. Per cent.	Fibre. Per cent.
Choice leafy lucerne chaff ..	18 to 22 ..	25 to 28
Good lucerne chaff	16 to 20 ..	27 to 30
Poor lucerne chaff	10 to 12 ..	31 to 35

Lucerne chaff for poultry should be finely cut to obtain the maximum consumption of the quantity supplied. When grain is fed it can be incorporated in the mash to the extent of 10 per cent. If the mash is to be fed in a moist state, the lucerne should be soaked before use, the time of soaking being arranged to suit the convenience of management. The quantity of water used for soaking should be just sufficient to mix a crumbly mash. This is the most economical method of using lucerne chaff as a green feed substitute.

Silage.

The feeding of silage as a substitute for green feed has proved very satisfactory in experiments conducted in the United States of America. Queensland poultrymen who have had some experience with silage speak highly of it. Silage may be made of many kinds of green feed. Legumes would undoubtedly prove the most nutritious, but barley, oats, lawn clippings, &c., will also make good silage.

Method of Preparation.—As silage for poultry should be made from young growths which are rich in protein, molasses is added. The material to be used should be cut, while still fresh and succulent, into lengths of about half an inch. Failing concrete silos, barrels or drums of a capacity of about 40 gallons may be used. Immediately after cutting, the material should be packed tightly into the silo which should be filled to the top. To each 40-gallon drum of material 2 gallons of molasses thinned with water (usually about 2 gallons) are poured over the top. The quantity of water is largely governed by the wilting that has taken place before chaffing. A weight of about 150 lb. to 200 lb. should be applied to the top of the silage, and it should then be left to stand for some time. Considerable settling down will take place permitting of more material being added the next day, after which the weight should be again applied. After a little more settling down has taken place the silo should be sealed. This is one of the most important points in the manufacture of silage. The most satisfactory procedure to adopt is to cover the silage with tarred paper or other waterproofed covering and place over it puddled clay to a depth of 2 to 3 inches. This should be inspected after about two days and again at later intervals. Any cracks which appear on its surface or between the drum and the clay should be plastered with more clay. With properly sealed silage the material used retains its colour, the juices are conserved, and the development of moulds, grubs, and larvae is checked. The development of these would make the use of the silage dangerous.

Method of Feeding.—Though they usually take to it readily, poultry may have to be accustomed to silage. The best method of introducing it to their ration is to mix it with the mash. Once they have become accustomed to it, silage may be fed as a green feed. It will be freely consumed, but 1 to 2 quarts per 100 birds will be found sufficient.

Effects of Feeding.—The quality of the eggs produced by birds fed on silage is not affected, nor have any other effects depreciating its value as a poultry food been noted.

MILK.

There is no better animal protein-rich food for all stock than milk. Skim milk, buttermilk, and whey—the most common milk products in Queensland—are foods of great value for poultry of all ages. Milk provides easily digested proteins, in addition to lactose, minerals, and vitamins, all of which are important for development, production, and health. Where skim milk is used to mix moist mashes, increased consumption and better development of young stock and increased production from layers follows. The lactose in the milk also helps to build up resistance to disease by keeping the intestines in a healthy state.

Fresh or soured milk is equal in food value. The feeding of milk as a drink is the only method by which quantities can be consumed by the fowl. Care must be exercised to see that the vessels from which milk is fed to poultry are kept clean and putrefaction avoided. Many adopt the practice of feeding the curds only, rejecting the whey. Whey, however, also had a definite food value, and should be used. When fowls are fed milk in open vessels considerable soiling of the feathers takes place. This gives adults an objectionable appearance and seems to affect the general health of young growing chickens. Therefore, chickens should be forced to drink milk through a grid.

It is generally accepted that 1 gallon of skim milk is equal in protein value to nearly 1 lb. of meat meal. Poultry farmers generally appreciate the necessity of efficient feeding, and to give their fowls the necessary amount of protein they should use prepared mashes or prepare mashes including meat meal. These mashes are usually fed with grain, the birds being given an equal quantity of each. In these circumstances a sufficient amount of protein is made available to the birds. The farmer who has a supply of skim milk available for his fowls must depart somewhat from his ordinary practice, for skim milk is a protein-rich food; but how far he may do so depends on the quantity of the skim milk available. When fowls are supplied with skim milk to the extent of 5 gallons per 100 birds per day, no other protein-rich food of animal origin is necessary. However, if the birds are given only, say, one-half of this quantity, half the quantity of mash that is usually fed should be supplied and the grain increased by about 50 per cent.

When milk, mash, and grain are being fed to the flock it is generally a sound policy to give the birds all the grain they will consume and not force them to eat given quantities of mash. This will enable the birds to balance their own ration.

COMMERCIAL FOODS AND THEIR FEEDING VALUE.

Barley.

Barley is not a popular food among poultry-keepers and fowls do not consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sprouted. When corn and wheat are high in price, barley may be used to the extent of 50 per cent. of the grain mixture, but the change over should be gradual.

Beans and Peas.

When whole, fowls do not take kindly to beans or peas; but if either is crushed it will add to the protein content of the mash, and may be used to the extent of 5 per cent.

Grain Sorghum.

In the drier areas sorghum may be grown successfully when maize or wheat is a failure. Sorghums are slightly higher in protein content than maize, and may be used in poultry rations as extensively as wheat.

Maize.

Maize is one of Queensland's staple grain crops. Poultry eat it readily. Large grain should be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is advisable to secure the small grain. The quality is then easily judged and there is no waste. Cracked grain should always be sieved before being used, and the fine powder used in the mash. Yellow corn should be used in preference to the white because of its vitamin A content.

Oats.

In some places oats is one of the principal poultry foods, but as most of Queensland's supply is imported it cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of it. It is high in fibre and unless hulled should not constitute more than 20 per cent. of a ration.

Whole Rice.

In the northern portion of Queensland where rice is grown, it may be possible to use quantities economically. It is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice should be used with care. It has a tendency to go rancid and is also high in fibre.

Wheat.

Wheat provides the bulk of our poultry food. It is readily consumed by poultry and can be fed as a part or whole of any grain ration, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

Bran.

Bran is rich in protein and mineral matter but contains a considerable quantity of fibre. This fibre is useful in adding bulk to the ration. It also assists in making a mash when fed wet of a desirable consistency. It may be used at the rate of up to 30 per cent. of the mash.

Pollard.

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It may form the principal constituent of mashes and be used to the extent of 60 per cent of the total mash.

Ground Oats, Rolled Oats, and Hulled Oats.

Ground oats—that is, oats without the hulls—is an excellent food for both laying and growing stock. The use of these foods is largely governed by the price.

Linseed Meal.

Rich in oils and proteins, also fibre, linseed meal may be used to the extent of 2 per cent. in the laying mash and increased slightly during the moulting period. It is very bulky when wet and reduces the appetite if fed in large amounts.

Cottonseed Meal.

Cottonseed meal, on analysis, would appear to be a splendid food for poultry, but in practice its extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but this quantity should never be exceeded as it spoils the keeping quality and yolk colour of the egg.

Peanut Meal.

Peanut meal is a protein-rich and easily digested food. Unless the fat content is low, the keeping quality is poor, as it is inclined to go rancid. It may be used to the extent of up to 5 per cent. in building up the protein content of a ration.

Meat Meals.

Meat meals vary considerably in their analyses. They are essential for high egg-production. When poultry are kept in closed runs where no other class of animal food is available, meat meals may be used to the extent of 10 per cent., but with stock on free range during periods when animal food in the form of insect life is plentiful, the quantity should be considerably reduced.

Dry Crushed Bone and Bone Meal.

Dry crushed bone and bone meal are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Poultry-keepers who are a distance from markets may build up a supply of mineral matter suitable for young stock by burning any bones about their property. After burning the bones are easily reduced to a size to feed.

Grits.

Shell grit, limestone, or crushed bone should be provided. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied either in the form of meal or grit.

Hard Flinty Grit.

Hard pieces of rock, sand, &c., are necessary to enable poultry to grind their food, and should be in free supply, particularly with stock confined to pens. Without grit it is impossible for stock to digest their food thoroughly, and any system of feeding where this is not supplied is wasteful.

Salt.

Salt needs to be well mixed with the mash; when wet mash is fed it may be dissolved in the water, but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash. Excessive quantities are poisonous.

[TO BE CONTINUED.]

The Seditester, Brisbane Type.

O. KUDELKA.

THE Sediment Test, first described in 1910 and applied with the well known Wisconsin type of machine, has many advantages and disadvantages.

It shows the unfilterable dirt present in one pint of milk under test and permits a rough classification. A very dirty filter pad indicates a very dirty milk, but does not indicate, of course, the dissolved and filterable dirt particles which readily pass through the filter. A clean pad, therefore, does not necessarily mean a very clean milk, since outside contamination may have been caused by soluble agents. No direct conclusion is possible as to the bacterial contamination and the keeping quality of the milk. Bacteriological and chemical changes may take place without any visible change in the appearance of the milk.

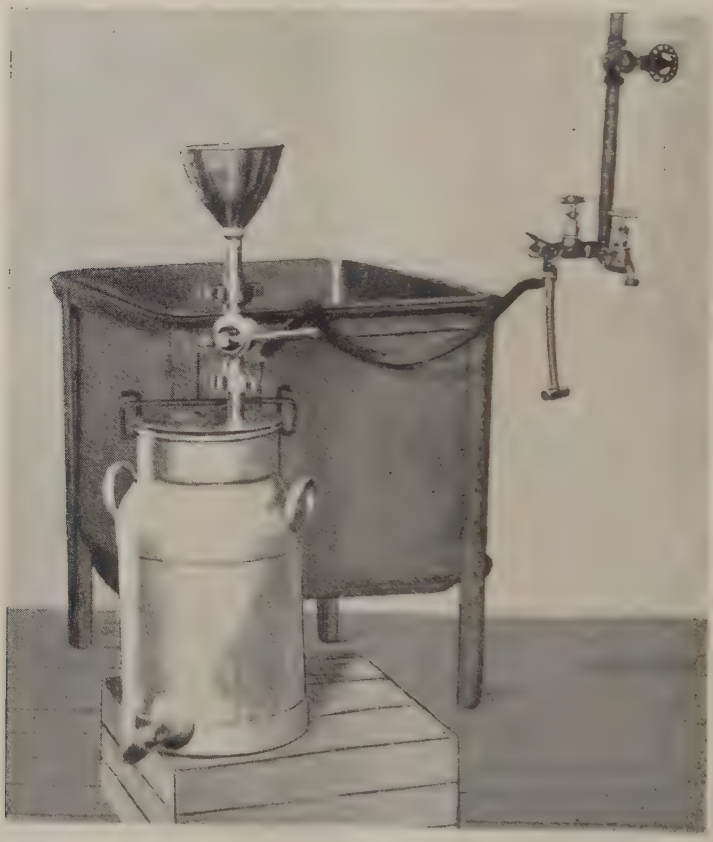


Plate 149.

SEDITESTER IN USE.—*Note*: The vat behind the seditester serves only as a receptacle for the water running from the water-jet vacuum pump.

Although it is not suitable to grade high-quality milk, the sediment test is undoubtedly useful in indicating low-quality milk, as dirt is always associated with bacterial contamination and, consequently, with the lowering of keeping quality.

The big advantages of this test are the speed and the simple equipment with which it is performed, so allowing objectionable milk to be rejected at the platform. Further more, the results of this test are easily recorded, and when communicated to the farmer they are far easier to understand and, therefore, more impressive than all other bacteriological and chemical tests.

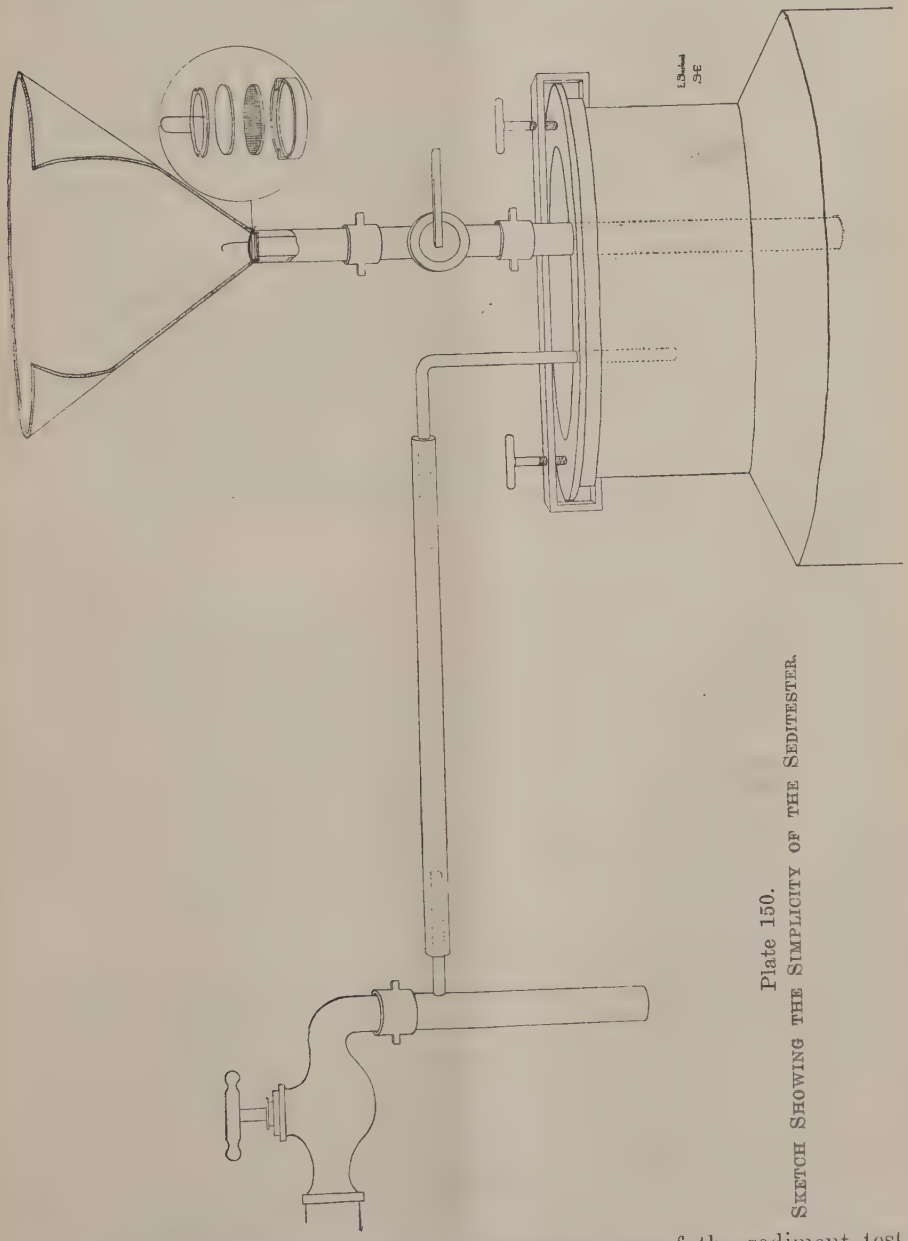


Plate 150.
Sketch Showing the Simplicity of the Seditester.

A practical setback to the more frequent use of the sediment test is that the commonly used Wisconsin type of machine (the gun) has to be opened at the top to pour in the milk and then at the bottom to

replace the filter pad, which takes time. Moreover, the milk has to be forced through by means of a blow ball, which is fairly tiring work. To carry out this test on a large number of cans without holding up the work on the milk platform, a gang of at least three men is usually necessary.

Considering the scarcity of labour and the probable necessity of employing young women for testing work, the construction of a sediment tester has been undertaken which will save work and can be handled easily by a girl.

The seditester is a simple apparatus built at small cost. The principle on which it works is a vacuum generated in a tapped 8 or 10 gallon milk can by means of a water or steam jet vacuum pump which can be attached to any pressure water supply (main water supply in towns or high tanks in country factories) or to any steam generating boiler.

The vacuum pump is connected to the can lid by a pressure rubber tubing and a tinned copper pipe ($\frac{1}{8}$ inch diameter). Mounted on the lid is a funnel (capacity $1\frac{1}{2}$-2 pints) which may be fitted with double walls to contain hot water. The funnel is connected to the lid by standard 1-inch cream fittings. All the fittings have one milk union and one cock, preferably of the gland-packed type, to ensure no air leakage. The sediment pad rests inside the funnel on a perforated metal gauze, and is kept in position by a metal ring which can be fixed to the wire diaphragm. The whole filtering system (gauze, pad, and ring) is removable from the funnel as a unit, and the filter pad can be changed quickly.

The lid is fitted to the can and made air-tight with a piece of rubber ring and clamps.

The milk to be tested is sampled in a quart container. One pint is run through the seditester (which takes 6 to 8 seconds according to the milk temperature). The other pint is kept as a reserve so that a second filter pad can be obtained to send to the farmer if necessary.

The seditester as described is already in satisfactory use in one big milk depot in Brisbane, and will be in use soon in another one.

The co-operation of Mr. D. Foreman, of the Metropolitan Milk Supply (G.B.) Ltd., who built the first model according to the description, is acknowledged.

SPLICING WOVEN WIRE FENCE.

A good way to make a permanent or temporary splice in woven wire fencing is shown in the drawing. The end of each horizontal wire is looped around a

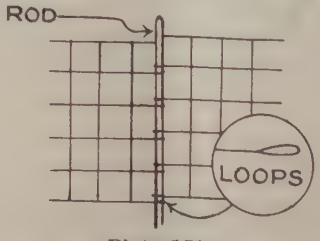


Plate 151.

$\frac{1}{2}$-inch, or larger, steel rod. One must be careful not to hook the opposite loops together. Whenever it is desired to take a woven wire fence apart at the splice, it is necessary only to pull out the rod.—P.B. in *The New Zealand Farmer Weekly*.

Factors Affecting the Quality of Milk for Cheese Manufacture.

W. J. PARK and V. J. BRIMBLECOMBE.

SYSTEMATIC cleanliness is the golden rule in dairy practice. The necessity for the utmost care in the production and handling of milk for cheese manufacture cannot be too strongly emphasised. A deterioration in quality is very rapid, unless hygienic principles are strictly applied. According to the extent to which milk is deteriorated during production and handling, the quality of the cheese manufactured will be lowered, for the cheesemaker cannot convert milk of low quality into satisfactory cheese.

As a milk grading test and for its educative value in assisting producers to locate and rectify faults in production, the methylene blue test should be applied regularly (say weekly) at cheese factories. The Wisconsin curd and fermentation tests are also useful for detecting the suppliers of inferior milk.

The most troublesome causes of defects and contamination in milk are:—

1. Unhealthy cows—producing abnormal milk.
2. Insanitary methods of production (Bacterial Defects).
3. Flavour tainting weeds and fodder.
4. Adulteration of milk.
5. Absorbed flavours.

1. Unhealthy Cows Producing Abnormal Milk.

The quality of milk is adversely affected by the use of milk from cows—

(*a*) *Too soon after calving* (*Colostrum milk*).—Milk from new cows should not be included with the normal milk until at least ten days after calving and sometimes longer, or until the milk is normal.

(*b*) *That have aborted.*—All aborting cows should be isolated, the milk discarded for cheesemaking, as it has a tendency to cause bitterness in cheese; and the cows affected ultimately sent to a meat works which is under supervision of a permanent Slaughtering Inspector.

(*c*) *Far advanced in lactation.*—Milk should not be used from cows less than 15 days prior to calving. It is sound practice to dry all milking cows off at least 6 weeks prior to calving.

(*d*) *Suffering from Mammitis.*—Mastitis milk is responsible for much trouble in cheese making, and should be excluded from the bulk supply. Cows suffering from Mastitis should be isolated and control measures applied. Careful dairy hygiene will assist to control this disease.

(*e*) *Affected with Three-day sickness,* or any other disease which adversely affects the normal health of the cows. Milk from such cows should not be used for manufacture of cheese.

2. Insanitary Methods of Production.

The bacterial defects such as unclean or "off" flavour, overripe, stale, fermented, yeasty, cheesy, tallowy, and gassy milk, originate in this manner—

(*a*) *Personal uncleanliness.*—The persons engaged in milk production should be clean in their personal habits, and in good bodily health, and when engaged in milking should wear clean overalls kept specially for this purpose. The milkers' hands should be washed after milking each cow. Wet hand milking should not be tolerated.

(*b*) *Failure to wash cows' udders and teats.*—Manure, dust, and dirt cling to the flanks, udders, and teats of the cows; and before milking, udders and teats should be washed with clean water to which has been added a chlorine preparation and wiped with a clean, dry cloth. During milking, this chlorine rinse should be changed as often as necessary. The udder cloths should be boiled daily and hung out in the sun to dry. It is a wise practice, while washing udders and teats, to milk the first three or four squirts from each teat into a vessel kept for this purpose. This first milk may be highly contaminated with undesirable organisms. Milk should be aerated and cooled and stirred. The night's milk should be placed in half-can quantities on a clean milk stand in a stock-and-dust free area and kept as cool as possible.

(*c*) *Dirty utensils and equipment.*—Dirty utensils are among the main sources of undesirable bacterial contamination of milk. All utensils—including strainers, buckets, coolers, cans, milking machines (more particularly the teat cup assemblies), milk lines, vacuum tank, and air lines, in fact any utensil which comes into contact with the milk—should be thoroughly cleansed and sterilized.

Dairy equipment—benches, wash-up trough, draining racks, sterilizer, or boiler—should be conveniently placed for efficient working and kept clean. All utensils and equipment should be maintained in good repair. Rusty utensils should be either retinned or dumped.

(*d*) *Unsatisfactory dairy buildings and surroundings.*—Dairy buildings should be kept in good repair, and the layout of yards should be so planned that milking can be done with the minimum of inconvenience and without unduly disturbing or exciting the cows.

The interior of the buildings should be limewashed or painted, and cobwebs removed periodically. The buildings should not be used as harness or store rooms.

Droppings should be removed from the yards daily to reduce manure dust to a minimum.

All milk should be placed on a convenient milk stand in a stock-and-dust-free area until delivery to the factory.

During delivery, a suitable cover to protect the milk from the sun should be provided, and early delivery should be maintained throughout the year.

(*e*) *Impure water supply.*—Ropy and slimy milk is chiefly caused by impure water. Drinking water for cows should be wholesome and supplied in suitably constructed troughs which can be regularly cleaned. Cattle should not be allowed to wade in swamps, dams, or water holes, and the ground around the water-troughs should not be allowed to become boggy.

Water for washing utensils and rinsing should be free from bacterial contamination. If the water is suspected of being impure, it may be treated with chlorine at the rate of half an ounce (½ oz.) of "Dairychlor" to 1,000 gallons.

Water from tanks at the milking shed becomes contaminated with manurial dust, and these tanks should be regularly cleaned, and sterilized with a chlorine preparation.

(*f*) *Inefficient methods of handling of milk.*—Incorrect methods of handling contribute to the deterioration of milk quality and especially to the following defects:—

(i.) *Overripe milk* caused by failure to properly aerate and cool the milk, and to keep it cool pending and during delivery; by not putting the night's milk on an approved milk stand, and so allowing the direct rays of the sun to shine on the cans of milk.

(ii.) *Dirty milk.*—This is caused by carelessness in methods of production and failure to use the cotton wool filter wad in straining. All milk for cheesemaking must be strained by wad filtering. Inefficient straining can be detected by the Sediment Test.

(iii.) *Churned milk*—free fat in the milk.—Mainly caused by failing to stir the night's milk; mixing of night's and morning's milk; by the agitation of milk over rough roads churning the fat in the milk.

3. Flavour Tainting Weeds and Fodder.

(*a*) Strong tainting weeds like carrot, mustard, hexham, stinking rodger, &c., cause an undesirable flavour in milk. These undesirable weed taints may be lessened by change of ration; allowing cows to graze on such feed immediately after milking, and taking them off some considerable time before the next milking. Cooling and thorough aeration of the milk also greatly assist in controlling weed taints.

(*b*) The feeding of strong fodders, viz., green lucerne, clover, &c., and silage and mouldy foods also causes undesirable flavours. Control measures may be adopted as stated above for weed taint.

4. Adulterated Milk.

(*a*) *Watered Milk.*—This may be detected by the use of the lactometer or by a determination of the freezing point.

The adulteration is mainly caused by deliberate watering, or by allowing flushing water from machines to flow into the milk.

The addition of impure water is detrimental to quality, and any water added lowers the yield of cheese. Watering is, moreover, an offence.

(*b*) *Skimmed Milk.*—Caused by skimming cream off the night's milk, or separation of portion of the milk and pouring the skimmed milk into the bulk supply.

Skimming may also be detected by the use of the lactometer. Skimming causes dry, hard, corky body; flat flavour; and decreases the yield of cheese.

(*c*) *Preservatised Milk.*—Chemical preservatives, viz., formalin, boric acid, salt petre, &c., are detrimental to cheesemaking. Most chemical preservatives affect the action of rennet and acidity, and increase the losses in cheesemaking.

Preservatives may be detected by various chemical tests. Milk adulterated with chemical preservative should be rejected at the Cheese Factory.

5. Absorbed Flavours.

Milk stored in an impure atmosphere or adjacent to any strong-smelling substance, will readily develop an "off" flavour by absorption of the particular smell. Contact with new or perished rubber inflations, rag strainers, untinned utensils, will taint milk, and it will readily take up disinfectant flavours if odorous disinfectants are used for washing cows' udders. Cleaners of a pungent-smelling nature should be avoided for the same reason. Exhaust fumes from engines and anything of an oily or kerosene nature will readily be absorbed by milk and cream, giving undesirable flavours.

A Domestic Solar Water-heating System.*

By G. BATES.

Design and Construction.

THE idea of utilizing the radiant energy of the sun as a means of heating water is by no means new, but it appears never to have been developed in Australia, in spite of eminently suitable conditions. An article written by Dr. H. W. Kerr, and published in the "Cane Growers' Quarterly Bulletin" for April, 1936, inspired the writer to construct a domestic unit with the object of testing it under North Queensland conditions. The results have been gratifying, and the following particulars regarding the construction and lay-out of the system are furnished in the hope that others will be encouraged to adopt this simple and cheap method of heating supplies of water for domestic and other purposes. It is appreciated that there are a number of points where experience has shown that this particular installation could be improved, but on the whole it is quite efficient and supplies all the hot water needed for the home.

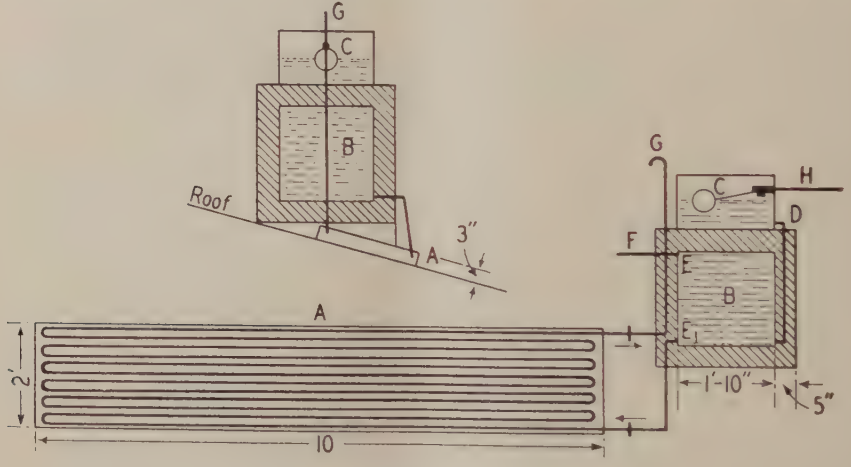


Plate 152.

ILLUSTRATING THE DESIGN OF THE SOLAR WATER-HEATING SYSTEM.

A.—Absorption chamber.
B.—Storage tank.
C.—Supply tank with ball valve.
D.—Connection from supply tank to storage tank, ¾ in.
E, E_1.—Connections from storage tank to heating coil, ¾ in.
F.—Connection to domestic supply pipe, ½ in.
G.—Vent pipe, ½ in.
H.—Connection to main water supply, ½ in.

The unit consists of two distinct parts, the *absorber* and the *storage tank*. The working of the system depends upon the ability of a black surface to absorb heat when exposed to the sun, and the fact that convection currents can be used to bring about continuous circulation of heated liquids. The absorber is composed of a bank of pipes or "flat" coil of

* Paper presented at the Cairns Conference of the Q.S.S.C.T., 1941. Adapted by permission of the Society for publication in *The Cane Growers' Quarterly Bulletin* for July, 1941, and reprinted from the *Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock).

¾-inch iron water piping, set on a sheet of galvanised iron within a shallow box, and protected from the cooling action of wind by a glass cover. The coil contains twelve lengths of piping each 9 feet 3 inches long, joined together by low pressure return bends (Plate 152). This length of pipe was selected mainly because it was obtained by cutting standard lengths of water-piping in halves, thus reducing the labour required to make the coil. To increase heat absorption, the coil and galvanised iron were painted black after setting in the shallow box. The dimensions of the box in this installation are 10 feet by 2 feet, giving a heat absorbing surface of 20 square feet. The upper part of the coil is connected directly to an insulated storage tank, while a feed pipe leads from the base of the storage tank to the lower portion of the coil; the base of the absorber is set somewhat lower than the bottom of the storage tank. The storage tank is made from plain galvanised iron and is insulated by a layer of sawdust of 5 inches minimum thickness; the use of a copper tank would be a distinct improvement.

The maximum amount of heat is absorbed when the rays of the sun strike the absorber at an angle of 90 degrees, but, of course, this angle could not be maintained throughout the whole day unless the absorber were mounted on gimbals and mechanically rotated. In practice, it is found sufficient to expose the absorber on a northerly slope of the house roof at an angle of some 15 degrees from the horizontal.

The operation of the system can best be explained by reference to the diagram (Plate 152). On exposure to the sun, water in the coil A becomes heated and rises by convection and flows slowly upwards, eventually entering the storage tank at its highest point, E. The warm water thus removed from the coil is continuously replaced by cooler water from the base of the tank through the outlet (E_1). There is thus a continuous circulation of water while the sun is shining, the temperature of the water in the storage tank gradually increasing throughout the period of sunlight. The household requirements are drawn from the topmost layer of water in the tank (this being the hottest zone) through the ½-inch pipe, F. The supply in the tank is then replenished from the base through the intake pipe, D, this flow being controlled by a ball valve operating in an overhead 6-gallon supply tank, C, connected with the service supply pipe, H. In order to minimise losses by radiation and maintain supplies of hot water overnight, good insulation of the storage tank is an obvious essential.

It has been determined in the United States of America that a minimum average of six hours' sunlight per day is necessary for the successful operation of a solar heater; under such conditions, 1 square foot of heating surface (i.e., the coil and the metal to which it is clamped) will heat 1 gallon of water per day to approximately 150 degrees F., the temperature rising with increasing hours of sunlight. The storage tank should be of ample capacity, and in a domestic installation it is a good rule to allow a daily average of about 15 gallons per member of the household, although this quantity can be reduced in warmer climates.

In the installation under consideration the capacity of the storage tank is slightly less than 40 gallons, while the area of the absorber is only 20 square feet, or half the generally recommended ratio. Against this, however, is the fact that the intake temperature of the water is comparatively high.

The cost of this installation, purchasing materials at retail rates in Cairns, and having the storage and supply tanks made by a local plumber, amounted to a little more than £10. The assembly and general construction were carried out by the writer and a friend, and, once the design was worked out, the time required was not great.

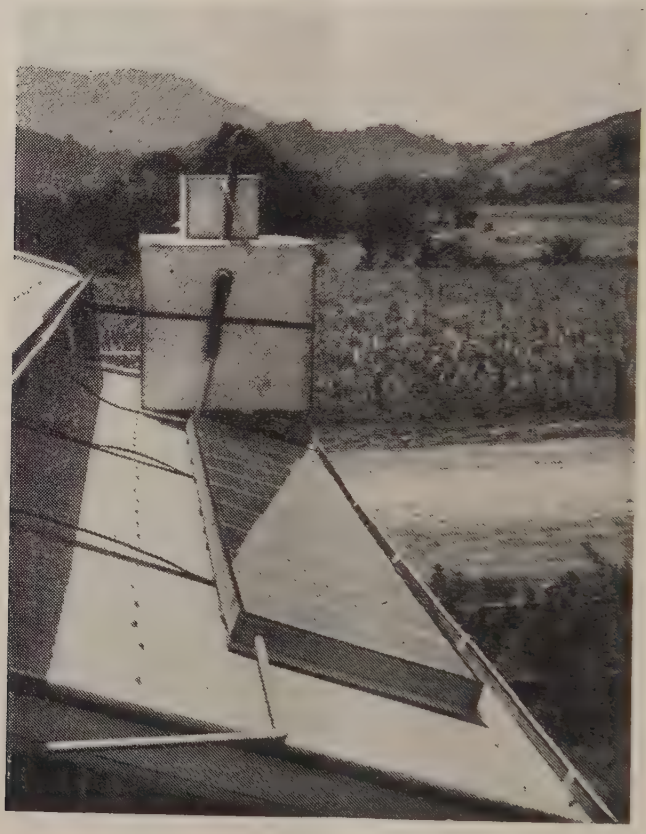


Plate 153.
ILLUSTRATING THE SOLAR WATER-HEATING SYSTEM.

Discussion.

Points Requiring Adjustment.—In an actual test, it was found that the unit was capable of heating 20 gallons of water from 95 degrees to 121 degrees on a bright, clear day in December. By some attention to the following points, it is felt that the efficiency of the unit could be greatly improved.

1. At present the tap over the kitchen sink is connected to the storage tank by 28 feet 6 inches of ordinary $\frac{1}{2}$-inch uninsulated water piping. The substitution of lightly insulated $\frac{3}{8}$-inch copper piping would eliminate much of the heat loss in transmission; moreover, in most cases it will be possible to place the storage tank much nearer the kitchen—where water is most frequently drawn. Uninsulated iron piping is also used in servicing the bathroom and wash basin.

2. Both the storage tank and the absorber rest on the roof, and, after 3 p.m., the tank, being on the western end, begins to shade the absorber. The best position for the storage tank is above the house ceiling, under cover of the roof.

3. The insulation of the absorber box is quite inadequate; the galvanised iron base rests on the galvanised iron roof, instead of being supported on an insulated floor, while, at the time of the above recorded tests, the panes of glass were laid loosely on the top of the box, instead of being sealed in. It is obvious that much valuable heat would be lost by these defects.

It has been stated earlier that the unit is operating in a manner satisfactory for our purposes, and this is no doubt due to the fact that the capacity of the storage tank is much greater than actual requirements. Nevertheless, it is obvious that with the provision of the recommended proportion of absorber surface (i.e., 1 square foot per gallon of tank storage), and the elimination of the abovementioned defects, it would be very easy to get a daily supply of 40 gallons of hot water at a temperature in excess of 150 degrees F.

Suitability for North Queensland Conditions.—We have pointed out that a minimum of six hours' sunlight per day is necessary for the efficient working of solar heaters, and thus Queensland should be almost an ideal place for their installation. Actually, some heat is absorbed even on cloudy days, but it must be expected that there will be times in the wet season when very little heating will take place. In order to investigate this point, the weather records compiled over the past four years at our Meringa Station were carefully examined. For the purposes of comparison and using 10 per cent. groupings, days with 0 to 30 per cent. of cloud were taken to be clear days; 40 to 70 per cent., to be partly clouded; and 80 to 100 per cent., clouded. On the basis of this assumption, the average number of days in each category for the four years 1937-1940 was as follows:—

Month.	Clouded.	Part Clouded.	Clear.	Average Max. Temp. °F.
January	12·5	6·5	12·0	91·7
February	11·5	6·0	10·5	90·8
March	12·0	6·0	13·0	89·1
April	9·0	7·5	13·5	86·4
May	9·5	9·5	12·0	84·0
June	10·5	7·0	12·5	81·0
July	11·5	7·5	12·0	78·4
August	8·5	4·5	18·0	81·2
September	6·0	6·0	18·0	85·0
October	7·0	7·0	17·0	88·3
November	8·5	6·5	15·0	91·2
December	3·0	7·5	20·5	92·6
Total	109·5	81·5	174·0	

From this, it is computed that on approximately 110 days per year, a solar heater in North Queensland would operate at materially reduced or low efficiency. On the other hand, with a suitably sized storage tank and adequate insulation, there is some carry-over of hot water from day

to day, so that a single day's cloudy weather would not seriously interfere with the operation of the system.

The records were then further searched to determine the number of days beyond the first, which were included in two-day or longer cloudy periods. The average number of such days was as follows:—

January	8·25
February	7·25
March	11·0
April	5·5
May	3·0
June	4·25
July	6·25
August	3·5
September	2·25
October	1·75
November	4·25
December	1·0
Total	58·25

That is to say, on the basis of low efficiency on cloudy days, and lack of carry over of hot water beyond the first cloudy day, on the average, hot water would not be available on some sixty days of the year, and on these occasions would have to be obtained from the supplementary source, whatever it might be, which had been operated in the past. On the other hand, residents of North Queensland could rely upon a free supply of hot water from a solar heater system for some 300 days of the year.

This period of constant hot water service would naturally be increased in areas west and south, where the proportion of cloudy weather is much less. Even in the north it could be further increased by the installation of a larger unit and provision for greater carry-over.

Refinements in Design of Solar Heaters.

The solar heater has been extensively developed in the United States, and particularly in California, where the ratio of cloud is low, and temperatures are mild in winter. It is used for heating water for hotels, apartment houses, industrial processes, for use in dairies, and for domestic purposes; in Hawaii, the system is widely used on the sugar cane plantations. Such installations naturally require the operation of very efficient units.

W. M. Farral, of the University of California (Bulletin No. 469, June, 1929), has carried out a thorough investigation of the principles of solar heater design and operation, and has found very considerable variation in the efficiency of different types. Contrasting black versus white absorbers, he found that, over a given period of exposure to sunlight, the standard black painted absorber raised the temperature of the water some 16 degrees F. more than did the white painted absorber.

In order to increase the heating surface of the absorber beyond that of the surface area of the actual pipes, it is usual to clamp the coil to

a metal plate (both being painted black), but better contact (and hence better heat conduction) between the pipes and the remainder of the absorbent surfaces is obtained by the affixing of metal fins to the pipes. A less expensive but efficient practice is to embed the coil partially in a thin layer of concrete, which forms a very efficient absorbing and conducting medium.

The value of the greater heating surface, such as is obtained by embedding the coil in a concrete bed, and of the use of glass to reduce the cooling effects, is demonstrated by data submitted by Farral, as under:—

Type of Absorber.	Temperature Increase in Water, °F.
Simple absorber, uncovered	9·6
Simple absorber, glass covered	15·7
Coil embedded in concrete, uncovered	15·5
Coil embedded in concrete, glass covered	19·0

By the use of a double layer of glass, re-radiation of absorbed heat may be reduced to a minimum and the heating capacity of the heater correspondingly increased; insulation of the absorber is also of great importance in the achievement of best results. Farral, working with an absorber insulated with 3 inches of cork board, has obtained air temperatures as high as 230 degrees F. beneath a single layer of glass, and 280 degrees F. beneath a double layer of glass.

Conclusion.

The solar heater method of heating large quantities of water is obviously well adapted for exploitation under the bright sunshine characteristic of Australia, and particularly of Queensland. It is, therefore, astonishing to find that the principle has never been adopted here. Enough has been said to demonstrate that the monetary outlay required for the installation of a domestic solar heating system is within the means of every householder; that the unit may be built by any enthusiastic amateur; and that a satisfactory hot water supply is assured even in the most cloudy part of the State. In a properly constructed unit the first outlay is the only outlay, and thereafter, year after year, the supply of hot water is available—convenient, abundant, continuous, and *free*.

A STACK PROTECTOR.

A good way to prevent stack tops from blowing off during a heavy wind is to make pull-proof pins from laths or slats. Saw a point on one end of the batten and cut two notches in each edge. Nail a short piece across the top and the pin

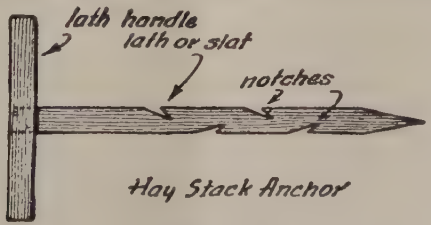


Plate 154.

is ready to be driven into the haystack. Placed at a distance of about 4 feet apart, the stack top should weather any breeze.—*The New Zealand Farmer Weekly.*

Corkwood, A Source of an Essential Drug.

A. D. PHILLIPS.

DUBOISIA,* a common Queensland plant which has lately acquired a new wartime significance, is one of the richest known sources of the alkaloid hyoscine, a powerful sedative agent which is almost a specific for treatment of certain mental disorders.

The small peace-time demand for hyoscine was easily satisfied by supplies from Central Europe and the Mediterranean countries, but war has cut off many of these sources of supply and at the same time enormously increased the demand. This has focussed attention on other sources of supply and the long-known fact that *Duboisia myoporoides* contains fair amounts of the alkaloid has brought it to the fore in this connection.

Dr. Joseph Bancroft is credited with the discovery of its value as a source of hyoscine. It is said that his attention was first drawn to the fact by reason of his daughter getting some of the green plant material in her eye. In common with several other plants of the natural order *Solanaceae* (to which *Duboisia* belongs), such as *Belladonna*, *Hyoscyamus, Stramonium*, &c., it possesses the property of causing dilation of the pupil of the eye. It was this phenomenon which caught Dr. Bancroft's notice and directed his attention to its medicinal properties.

The tree itself, which is somewhat shrub-like, does not, as a rule, attain any great height, average specimens reaching 10 to 15 feet. It is found right along the coastal belt of Queensland and Northern New South Wales. The trunk and major limbs are covered with a close-knit bark which varies somewhat in colour from a light-grey to a light-brown, the younger growth and twigs being of a somewhat darker shade of brown.

The foliage is on the whole sparse. The leaves themselves (see sketch) are dark-green in colour and succulent. They are greatest in breadth towards the apex, which is fairly blunt, and taper back towards the leaf stalk. The midrib is well defined and marked by a line on the upper surface of the leaf. The margin of the leaf is often slightly indented as shown in sketch. During the summer months the tree bears small ivory white flowers each of which is later superseded by a black berry. The calyx of the original flower does not fall as a rule, but persists at the back of the berry.

As a result of the present great demand for hyoscine in England it is now being extracted from *Duboisia* leaves in Australia and sent there. Difficulty in obtaining regular supplies of leaf is, however, curtailing the amount produced, and it is urgently desired to obtain more, if possible.

A word of warning should be sounded on one or two matters in connection with this plant. Hyoscine is a powerful poison and its ingestion into the human system in the very smallest quantities may give rise to serious effects. It therefore behoves anyone handling *Duboisia* leaves to take care lest any plant material enters the eyes, mouth, or nose, or comes into contact with broken skin, or tender parts of the body.

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* *Duboisia myoporoides.*

Plate 155.

DUBOISIA MYOPOROIDES, R. BR.—The "Cork Wood" or "Duboisia." A. Flower. B. Flower dissected, showing 4 stamens; a fifth is aborted. C. Calyx and Pistil. D. Fruit. E. Seed.

It should also be borne in mind that *Duboisia myoporoides* should not be confused with *Duboisia Hopwoodii,* commonly known as "pituri." This latter occurs more in the western areas of Queensland and is useless as a source of hyoscine.

Plate 156.

The Government Botanist, Mr. C. T. White, to whom I am indebted for assistance in compiling this note, points out that another tree, commonly known as "corkwood" in Queensland, is *Erythrina vespertilio.* This has large red or salmon coloured flowers, whereas the flowers of *Duboisia myoporoides* are small and white. The limbs, especially the smaller ones, are armed with sharp, strong, conical prickles, which are absent from *Duboisia. Erythrina* has no value at the present time.

Fig Cultivation.

FIGS for use as fresh fruit grow well in Queensland, both in coastal and tableland districts. The soils most suited to their culture are good sandy loams and medium loamy soils provided with good drainage. Very severe frosts will kill the young wood unless properly matured.

Propagation.

Propagation in this State is by means of cuttings selected from matured wood of the season's growth. Cuttings should be selected during July or August and be about a foot in length, with a bud just above the cut at the base end. When planting in nursery rows allow only one or at most two eyes to remain above the ground. The following winter they may be transplanted to the orchard, being set out at a distance of about 25 feet apart each way.

Varieties.

There are many varieties of figs in different parts of the world, some are valuable for drying, whilst others are only of use as fresh fruit. Those chiefly grown in this State are White Adriatic, Brown Turkey, Purple Genoa, and White Genoa. These all set fruit without pollination.

True Smyrna figs are best for drying, but the fruit will not set without fertilization by the Blastophaga wasp from the Capri fig.

The fig fruit appears to grow direct from the tree without flowering; actually each fig is the fruit of hundreds of flowers which form inside the fig itself. For this reason it has been aptly termed the "inside out fruit." The only access to these flowers is through a small eye or opening at the apex of the fruit, and for that reason ordinary pollenising agents such as bees cannot reach them. The tiny Blastophaga wasp, a native of Asia Minor, is necessary for pollination; this insect does not exist in Queensland, and it is on this account that some varieties of figs growing here drop their fruit before it matures. The varieties mentioned above and some others will form fruit without pollination by the fig wasp, and thus are very suitable for growth in this State.

Pruning.

Pruning is a simple matter. As a general rule it is not advisable to prune heavily. After planting-out the tree is cut back to about 18 inches in height, and three or four evenly spaced branches allowed to develop. These branches usually throw out secondary branches as well as laterals so that the tree naturally grows into a good shape. Any laterals which crowd the centre of the tree may be cut right out. Once a fig tree is given its proper shape the less it is cut about the better. If the growth is too thick the young wood may be thinned out where several branches start together from the same limb. Thus, in heavy-growing fig trees such as the White Adriatic the young bearing wood should be at least 2 feet long without side branches. All other twigs may be cut off close to the main branch, though they should never be just cut back leaving a stump. Always cut them off close to the mother branch. The latter will then bear better and larger figs. The pruning of the fig when grown in the open should be confined to three or four distinct points:—(*a*) The sterile twigs found at the base of the main branches should be cut off each year. These twigs are generally bent downward, are slender, and seldom bear fruit. (*b*) Larger as well as smaller branches which cross one another should be so cut out that no further interference is possible. (*c*) Lower branches too close to the ground should also be cut off close to the main stem or main branches: and (*d*) if a tree is unevenly balanced, the branches on the larger side should be cut back in order to properly balance the tree.

Pruning is best done when the leaves have fallen and the fig tree is most dormant. Some sap will always flow, so the more dormant the tree the better.

THE FRUIT MARKET.

JAS. H. GREGORY, Instructor in Fruit Packing.

AS these notes are being written in Sydney, their main interest will be from the standpoint of those shipping south. Examination of various Queensland fruits reveal the following.

Bananas.—Some poor lines of angular fruit are coming to the market and are hard to sell. Some growers branding the grade sixes as sevens.

Pineapples:—Some fine lines are on view, although many are spoiled by not being cut. Yeasty Rot has made its appearance in some consignments.

Tomatoes:—A more careful selection of fruit for A grade packs would have returned many growers 1s. to 3s. more per case. The very high prices prevailing have influenced many growers into believing that they have done well. The price range on one occasion of 3s. 6d. to 24s. per case speaks for itself, particularly when fruit 12s. to 24s. was easier to sell than that of lower price.

The main trouble on the market is still not an over-production, but an over-marketing of low-grade fruit.

Prices during the last week of October were:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Sixes, 6s. to 8s. 6d.; Sevens, 7s. to 10s. 6d.; Eights and Nines, 8s. to 14s.

Sydney.—Cavendish: Sixes, 8s. to 10s.; Sevens, 10s. to 13s.; Eights and Nines, 13s. to 16s. Specials in each grade higher.

Melbourne.—Cavendish: Sixes, 7s. to 9s.; Sevens, 9s. to 11s.; Eights and Nines, 10s. to 13s.

Adelaide.—Cavendish: Sixes, 10s. to 13s.; Sevens and Eights, 12s. to 15s.

Brisbane.—Lady Fingers, 3d. to 9d dozen.

Pineapples.

Brisbane.—Smooths, 4s. 6d. to 8s. per case; 2s. to 6s. 6d. dozen. Roughs, 8s. to 10s. per case; 1s. to 6s. per dozen.

Sydney.—7s. to 12s. Some Yeasty Rot showing.

Melbourne.—8s. to 13s. case.

Adelaide.—14s. to 16s.

Newcastle.—9s. to 11s.

Papaws.

Sydney.—7s. to 15s. tropical case. Northern growers would do well to send less advanced in colour.

Melbourne.—8s. to 10s. Green fruit hard to sell.

Newcastle.—8s. to 10s. tropical case.

CITRUS FRUITS.

Oranges.

Brisbane.—Local Commons, 5s. to 9s. case; Imported, 5s. to 11s.

Lemons.

Brisbane.—6s. to 10s. bushel.

OTHER FRUITS.

Avocado.

Brisbane.—7s. to 9s.

Sydney.—12s. to 16s. half bushel.

Strawberries.

Sydney.—Strawberries have now disappeared from the market.

Passion Fruit.

Brisbane.—Firsts, 14s. to 18s.; Seconds, 8s. to 12s. half bushel.

Sydney.—12s. to 20s. half bushel.

Tomatoes.

Brisbane.—South Queensland: Coloured, Choice, 8s. to 12s.; Smalls, 3s. to 6s.; Ripe, 4s. to 9s. per half bushel; Green 6s. to 12s.; Bowen, 3s. to 7s.; Yarwun, 3s. to 8s.

Sydney.—South Queensland: Redlands Coloured, 10s. to 15s.; Green, 8s. to 13s.; Smalls (hard of sale), 3s. to 7s.; Bowen, 5s. to 10s.

VEGETABLES.

(Brisbane prices only, unless otherwise stated.)

Beans.—Brisbane, 2s. to 6s. bag; Sydney: Queensland beans, 5s. to 6s. bushel. Slow of sale owing to large stocks locals.

Peas.—Local and Stanthorpe, 9s. to 12s.; Inferior lower.

Cabbage.—3s. to 6s. dozen; Inferior lower.

Carrots.—4d. to 2s. bundle; Sydney, 20s. to 42s. cwt.

Beetroot.—3d. to 9d. bundle.

English Potatoes.—Old, 2s. 6d. to 5s.; New, 3s. to 8s.

Sweet Potatoes.— 2s. 6d. to 3s. 6d. sugar bag.

Cucumbers.—Locals, 5s. to 9s. bushel; Northern, 4s. to 8s. bushel; Sydney, South Queensland, 10s. to 15s.; Bowen, 4s. to 8s.

Rhubarb.—6d. to 1s. bundle.

Celery.—Local, 6d. to 1s. 6d. bundle.

Marrows.—Sydney, 6s. to 9s.; Melbourne, 10s. to 12s. tropical case.

List of Registered and Rejected Stallions.

REGISTERED STALLIONS.

Subjoined is a list of stallions in respect of which Certificates of Registration were issued under "*The Stallions Registration Acts, 1923 to 1940.*" during the year 1941-42:—

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1941-42.

Name.	No.	Age.	Colour.	Owner.
A.B.	2788	Aged	Black	F. J. Armstrong, Pilton road, Clifton
A.D.S.	2803	Aged	Chestnut	R. Dennis, Beenboona, Clermont
Air Cadet	2804	5	Chestnut	C. A. Heaton, Glenmore, Clermont
Alistar	2844	Aged	Brown	E. J. Payne, Le Lante, Chinchilla
Anarivo	2877	5	Bay	M. Ryan, Bayview terrace, Eagle Junction
Auburn Edge	2878	5	Bay	W. Mumford, Rocklea
Avelon	2805	Aged	Bay	G. B. Travers, Yarrai, Springsure
Bargara	2879	5	Bay	Mrs. E. Campbell, Wonbah, Mount Perry
Black Gauntlet	2806	Aged	Black	A. M. L. and F. Co., Retro, Clermont
Calm Simon	2845	5	Bay	J. Kennedy, Kumbia
Calvous	2846	Aged	Chestnut	J. Leahy, Vale View, Kinbombi
Canning Gold	2789	5	Chestnut	T. J. Carey, Junabee road, Warwick
Chris Beauford	2790	Aged	Chestnut	F. T. Fischer, Killarney
Corio	2880	5	Bay	L. J. Driscoll, Eagle terrace, Sandgate
Crystal Brook	2791	Aged	Chestnut	T. Cowley, Ellinthorp
Dainty Revenue	2881	5	Chestnut	W. Reynolds, Winchester street, Hamilton
Dammann	2882	Aged	Bay	L. Nicholls, Long avenue, Hendra
Dandy	2778	5	Bay	H. G. Wood, Kupunn
Double D.	2807	6	Brown	J. S. McCormack, Diamond Downs, Clermont
Dusty Fox	2792	Aged	Brown	W. H. Treweeke and Sons, Umbercollie, Goondiwindi
Flametto	2808	Aged	Brown	E. A. White, Keilambete, Ruby Vale
Flying Cloud	2847	Aged	Bay	T. A. Bellotti, Ashfield Farm, Murgon
Fordite	2809	Aged	Brown	N. Flohr, Sandy Creek, Clermont
Gamin	2883	Aged	Bay	G. Reinke, Rosewood
Glen King	2810	6	Bay or brown	A. Shannon, Saltbush Park, St. Lawrence
Golden Corn	2812	5	Chestnut	A. Shannon, Saltbush Park, St. Lawrence
Gold Yet	2813	5	Chestnut	H. P. Bailey, Ulmara, New South Wales
Gordon	2814	Aged	Brown	W. J. Miller, Anmore, Clermont
Hebray	2815	6	Bay	W. H. Schnitzerling, Alpha
Heroic's Double	2779	6	Chestnut	C. R. Crowther, Cambooya
High Bachelor	2764	6	Bay	A. S. Burchmann, Lockrose, Forest Hill
High Rank	2884	5	Bay	T. M. Ahern, Gresham Hotel, Brisbane
Kialla Valley	2885	Aged	Bay	L. and A. Edwards, Palm street, Hendra
Laird	2816	Aged	Brown	W. P. Hamon, Clifton, Ubobo
Leading Lad	2817	5	Bay	C. A. Barnard, Coomooboolaroo, Duaringa
Maxson	2818	Aged	Brown	W. C. C. Hansen, Redrock, Clermont
Mr. Standfast	2868	Aged	Bay	T. Jennings, Greenmount
My Don	2793	Aged	Brown	J. Crockett, Willowvale, Warwick
My Toy	2886	5	Chestnut	G. Miller, Chamber's Flat
Pantius	2889	5	Bay	J. C. Webb, Manson road, Hendra
Peppen Dyne	2890	5	Brown	J. C. Webb, Manson road, Hendra
Rahmond	2795	Aged	Bay	R. R. Allen, Campbell's Plains, Warwick
Raingard	2819	6	Bay	W. Roberts, Rooken Glen, Bogantungan
Rayard	2820	5	Black	E. Adams, Edungalba
Rexmont	2848	5	Bay or brown	R. S. Browne, Brooklands
Rocket	2796	5	Grey	H. Wagland, Wonga, Goomburra
Roi Dennis	2821	6	Bay	A. Symons, William street, Rockhampton
Roman Prince	2871	5	Bay	J. Y. Shannon, Rodney Downs, Ilfracombe
Royal Boy	2765	5	Brown	D. J. Mallon, Ingoldsby
Roymond	2870	6	Bay	A. Bell, Caboolture
Sarcallem	2822	5	Grey	Jim White, Kunwarara
Sarlou	2823	Aged	Grey	C. A. Becker, Theodore
Scapularis	2887	6	Bay	L. J. Williams, care of L. G. Lowe, Bridge street Albion
Seascape Boy	2872	Aged	Bay	S. Manning, Aspley
Sir Neville	2824	5	Brown	P. J. Hanrahan, Gogango
Some Fire	2849	6	Brown	H. J. Pownall, Mundubbera
Spear Measure	2891	5	Bay	E. Bailey, Nindigully
Spear Vale	2892	5	Bay	W. Tucker, Bowley street, Hendra
Steel Coat	2825	5	Brown	H. A. McCartney, Donside, Canoona
Sydney	2893	Aged	Chestnut	R. Beak, Wilangi, Wumalgi
The Vision	2826	Aged	Chestnut	C.Q.M.E. Co., Avon Downs, Clermont
Thracian	2869	Aged	Chestnut	A. Strong, Lismore
Tola Speech	2827	5	Bay	F. M. Madden, Yaamba
Top Scholar	2797	Aged	Chestnut	E. McKenna, Mill Hill, Warwick
Torpedo	2780	6	Brown	J. C. Clark, A.M.P. Chambers, Brisbane

Pony Stallions Certificated for Life during Year 1941–42.

Name.	No.	Age.	Colour.	Owner.
Abdulla	2828	5	Bay	P. Smallcombe, Bororen
Aladdin's Son	2850	5	Grey	L. C. Walker, Bingera, Bundaberg
Bagdad	2894	5	Bay	A. Humphrey, Jimboomba
Black Prince	2766	5	Black	J. C. Davey, Abbeystead, Gatton
Boonah Joy	2767	5	Taffy	W. Coyne, Grandchester
Bright Gay Lad	2768	5	Bay	F. Huth, Haigslea
Cabulcha Quicksilver	2769	5	Bay	J. M. Newman, Caboolture
Cannon Lad	2895	5	Bay	Mrs. K. Cox, 4th Avenue, Sandgate
Don	2781	5	Bay	J. C. Naumann, Rosevale
Golden Primus	2798	6	Chestnut	W. B. Backhouse, Back Plains
Harir's Image	2851	5	Bay	J. R. Perrett, Mount Hope, Kingaroy
Joker	2770	Aged	Chestnut	K. Clarke, Stony Creek, Woodford
Mercurial Star	2771	5	Grey	S. J. Schofield, Woodford
Night Shade	2852	6	Grey	J. T. S. Seiler, Durong, *via* Proston
Peter	2896	Aged	Chestnut	J. Volck, Kuraby
Phantom	2829	6	Grey	W. P. Hamon, Clifton, Ubobo
Playboy	2782	5	Piebald	Miss J. E. Taylor, Kulpi
Prince Carda	2830	Aged	Bay	C. H. Hammond, Ubobo
Storm	2783	5	Piebald	J. E. Gamble, Biddeston
Talafa	2831	Aged	Bay	Mrs. A. M. Burns, Talafa, Gindie
The Shah	2873	6	Grey	W. E. Webster, Sarum, Kingaroy
Tommy Boy	2853	6	Grey	S. M. Edwards, South Side, Gympie
Walker's Pride	2772	5	Brown	Mrs. E. C. Hayes, Harrisville
Young Cygnet	2799	5	Bay	P. H. Elks, Reeve's Gully, Stanthorpe

Trotter Stallions Certificated for Life during Year 1941–42.

Benowa Derby	2854	6	Bay	F. Tucker, Ellesmere, Kingaroy
Broad Wilks	2855	6	Chestnut	T. J. Burns, Mannuem, Kingaroy
Edward Harem	2097	5	Black	G. O. G. Kriedemann, Upper Coomera
Joker's Pride	2856	5	Bay	W. H. Meyers, Tiaro
Louis Belmont	2876	5	Chestnut	R. H. Wilson, Aratula
Stormalong	2898	6	Brown	J. Cockcroft, Aspley

Draught Stallions Certificated for Life during Year 1941–42.

Banker	2857	Aged	Bay	W. Taylor, Barambah Creek, Gayndah
Captain	2832	5	Bay	C. Ambrose, Marmor
Captain Keynote	2833	Aged	Bay	Fitzroy Estates, Jellinbah, Blackwater
Captain Lustre	2858	6	Bay	J. T. Collett, Pomona
Captain Starlight	2773	5	Bay	C. Brown, Linville
Charley	2899	Aged	Bay	E. Geissmann, North Tamborine
Claude	2834	Aged	Bay	B. B. Marshall, Springsure
Dapple	2835	6	Grey	J. Peckett, Pines, Springsure
Dignity Lad	2784	5	Bay	J. H. L. Von Pein and Son, Pittsworth
Don	2859	6	Bay	J. A. Bawden, Moolboolaman
Donald	2836	6	Bay	A. Wienholt, Marmadilla, Springsure
Duke	2860	6	Grey	C. Carlson, Kandanga
Gay Boy	2837	5	Bay	Chalk and Son, Clermont
Gay Boy	2838	5	Bay	W. L. Pownall, Leichhardt Downs, Clermont
Ideal Tim	2861	6	Bay	W. E. Sauer, Gayndah
Irton Pride	2862	5	Bay	E. J. Keys, Proston
King Donald	2800	5	Bay	N. A. Pollock, Araluen, Goondiwindi
Kircaldy Journalist	2863	5	Roan	R. Ewart, Barambah road, Nanango
Kirkcaldy Preference	2774	5	Bay roan	W. Profke, Glamorgan Vale
Lofty	2839	6	Bay	C. H. Pershouse, Benaraby
Mountain Chief	2840	5	Bay	A. Marlow, Thangool
Pine Vale Darnley	2874	5	Bay	State Farm, Palen Creek
Prince Globe	2875	Aged	Bay	Forge Bros., Tamworth
Royal Dignity	2864	5	Bay	E. Reinbott, Crawford
Royal Duke	2865	6	Bay	A. H. Lowe, Bollier
Royal Lustre	2775	5	Bay	H. A. Stuhmcke, Glenore Grove
Sir Dignity	2785	5	Bay	P. Keane, Linthorpe
Siren	2786	5	Grey	D. A., A. F., and H. L. Wormwell, Meandarra
St. Helen's Cavalier	2787	Aged	Bay	W. Baumgarten and Sons, Meandarra
Sultan Duke	2776	6	Brown	R. Tones, Mount Kilcoy
Talgai	2841	5	Bay	Chalk and Son, Clermont
Terang Duke	2801	5	Bay	C. A. H. Head, Swanfels
Trementheere Royal	2866	6	Bay	A. H. Tanzer, Abercorn
Trump	2842	Aged	Bay	Estate J. H. Wells, Rewan, Rolleston
Vamhire Heir	2777	5	Bay	F. H. Hahn, Coulson
Warrah Knight	2843	6	Bay	R. Schmidt, New Twin Hills, Clermont
Wyoming Final Tide	2867	5	Bay	Fairymead Sugar Co. Ltd., Bundaberg

Blood Stallions Certificated for the Year 1941–42.

Arrowloon	2085	4	Chestnut	R. M. Nolan, Blair Athol
Bachelor's Patrol	2096	4	Chestnut	F. J. Burgess, Ellesmere, Kingaroy
Beau Force	2058	4	Bay	E. Blomfield, Meenawarra, Cecil Plains
Beau Geste	2086	3	Bay roan	J. P. O'Connor, Miriam Vale
Blazer	2059	4	Bay	H. V. Littleton, Crow's Nest
Bluecoat	2087	3	Chestnut	C. F. G. Collins, Strathmuir, N. C. Line
Brown Beau	2098	3	Bay	R. L. Horton, Dallarnil
Calliope	2088	4	Grey	Fitzroy Estates, Jellinbah, Blackwater

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1941–42—*continued.*

Name.	No.	Age.	Colour.	Owner.
Dauntless	2092	3	Bay	Estate T. M. Kelly, Glen Isla, Kunwarara
Da Vinci	2039	3	Brown	A. Korner, Kulgun
Dean Mond	2089	4	Bay	H. A. McIntyre, Ruby Vale
Feu-de-Joie	2112	4	Chestnut	A. Strong, Lismore
Flying Prince	2069	3	Chestnut	Mrs. D. F. Turkington, Pilton
Gaine On	2097	3	Bay	R. W. Ball, Dakiel
Grey Lad	2071	4	Grey	H. M. Glasser, Goondiwindi
High Spear	2090	4	Chestnut	E. H. Faint, Pioneer, Clermont
Lyonjack	2118	4	Bay	V. Corvi, Mitchelton
Ned Kelly	2070	6	Bay	J. J. Murphy, Emu Vale (Provisional)
Noble Denis	2072	4	Chestnut	K. J. J. Brosnan, Killarney
Promise	2073	3	Bay	J. Brosnan, Killarney
Rabbi Chief	2119	4	Chestnut	E. Fitzgerald, Austin street, Newstead
Rambling King	2074	3	Brown	E. A. Chandler, Silverspur (Provisional)
Royal Spear	2040	4	Bay	R. Jackson, Munbilla
Sassoma	2113	3	Bay	A. Strong, Lismore
Sunrise	2091	3	Brown	E. A. Hawkins, Ducalbrook, Bogantungan
Wheat Grain	2093	4	Bay	N. G. Walker, Fairfield, Duaringa
Worrah	2120	4	Bay	T. Ryan, Worrah, Goondiwindi

PONY STALLIONS CERTIFICATED FOR THE YEAR 1941–42.

Bobbie	2041	3	Brown	D. Neilson, Riverview, *via* Ipswich
Byron	2042	4	Creamy	E. A. Costello, Lacey's Creek, Dayboro'
Dr. Robin	2114	4	Bay	A. W. Luton, Murwillumbah
Gay Lad	2060	4	Bay	L. W. Henschell, Yarranlea
Little Foot	2115	3	Bay	A. W. Luton, Murwillumbah
Lord Leo	2061	4	Brown	F. Donnelly, 4 Dally street, Toowoomba
Stormy	2043	4	Piebald	M. G. Beetham, Forest Hill
Toy	2062	3	Black	C. H. Pendergast, Brigalow

TROTTER STALLIONS CERTIFICATED FOR THE YEAR 1941–42.

Dusky Derby	2121	4	Bay	H. H. Napper, Pimpama
Flying Teddy	2099	4	Chestnut	B. Gannon, Ellesmere, Kingaroy
Sing Boy	2063	4	Bay	W. O. Brennan, Oakey
Teddy's Memory	2116	3	Brown	B. Stephan, Templin

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1941–42.

Abbey Day	2044	3	Black	H. Zirbel, Mount Sylvia
Ballymena Intent	2124	5	Bay	M. F. Cornford, Drillham (Provisional
Balwherrie Prince	2122	3	Brown	W. Davidson, Boyland
Billabong Henry	2045	4	Bay	Queensland Agricultural High School and College, Lawes
Bob	2094	3	Bay	W. J. Tysoe, Marmor
Bonnie Outlook	2075	3	Bay	M. W. Browne, Loch Lomond, Warwick
Bruce	2100	3	Brown	V. A. Heading, Manyung, Murgon
Canaga's Duke	2064	4	Bay	M. H. Piekthorne, Canaga, Chinchilla
Captain Glen	2101	3	Bay	W. C. Dong, Adelaide street, Maryborough
Caringal Kerr Gay	2076	4	Black	O. Zackrisen, Swanfels
Caringal Sandy	2077	4	Black	C. A. H. Head, Swanfels
Conondale Lad	2102	3	Bay	T. G. English, Conondale
Crystalene	2078	4	Bay	T. M. Brown, Willowvale, Warwick
Crystal Hope	2079	4	Bay	N. D. Nicholls, Pratten
Crystal Intent	2080	4	Black	V. C. Cutmore, Swanfels
Crystal Prince	2081	4	Black	N. D. Nicholls, Pratten
Fairymead Bold Romany	2103	3	Bay	Fairymead Sugar Co. Ltd., Bundaberg
Glengoon Chancellor	2104	4	Bay	F. E. Mitchell, Byee, Murgon
Glenrandle Ebb Tide	2082	3	Bay	P. Kerlin, Glenrandle, Killarney
Heroic's Pride	2095	3	Bay	W. R. Duncan, Blair Athol
Honest Rocket	2105	4	Bay	C. R. McConnell, Mundubbera
Joker	2065	4	Brown	J. H. Brown, Wutul
Jondaryan Adieu	2066	6	Bay	J. A. Tyson, Felton, Cambooya (Provisional)
Kimbar Knightley Lad	2046	3	Black	A. C. Wagner, Boonah
Laurence Drew	2083	3	Bay	E. C. McConville, Mount Sturt, Killarney Line
Lustre Again	2047	3	Bay	L. N. Edwards, Mulgowie
Major	2123	3	Bay	T. C. Wendt, Waterford
Majuba Rex	2067	4	Black	S. O. Mear, Toowoomba
Navillus Master Stroke	2117	3	Bay	C. O'Sullivan, Greenmount
Netherdale Rising Tide	2068	3	Bay	H. C. Sperling, Crow's Nest
Prince	2106	4	Bay	A. P. Conway, Wonga, Woolooga
Rose Farm Lord Lustre	2048	4	Brown	R. Drew, Forest Hill
Royal Chief	2107	3	Bay	H. E. M. Leggatt, Norwood, Gayndah
Royal Laddie	2108	4	Bay	Jackson and Paulger, Obi Obi
Royal Prince	2109	3	Blue roan	L. Harvey, Biggenden
Socks	2110	3	Bay	J. W. Anderson, Lagoon Pocket, Gympie
Sunnyvale Lustre's Choice	2049	3	Bay	C. A. Gnech, Teviotville, Boonah

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1941–42—*continued.*

Name.	No.	Age.	Colour.	Owner.
Sunnydale Prince ..	2050	3	Bay roan ..	F. W. Weier, Hatton Vale, Laidley
Surrandene Marquis ..	2051	4	Brown ..	J. Lehmann, Coolana, Rosewood
Tent Hill Fashion Pride	2052	3	Bay ..	W. H. Grams, Upper Tent Hill
Trumps	2111	4	Bay ..	A. A. Meissner, Coolabine Creek, Eumundi
Willowbank Skipper ..	2053	4	Black ..	T. O. Gnech, Boonah
Willowbank Star ..	2054	3	Black ..	J. Hamilton, Forest Hill
Willowbank Victor ..	2055	3	Bay ..	J. Hamilton, Forest Hill
Willow Grove Pride ..	2056	3	Bay ..	H. D. Redinger, Mount Sylvia
Young Hero	2057	3	Bay ..	J. J. Ahearn, Lower Mount Walker, Rosewood
Yugo	2084	3	Bay ..	J. O. Coleman, Cobba-da-mana

REJECTED STALLIONS.

List of stallions in respect of which Certificates of Registration were refused on account of lack of type and/or conformation, lack of size or unsoundness, during the year 1941-42. These horses are prohibited from service, either public or private:—

BLOOD STALLIONS REJECTED DURING THE YEAR 1941–42.

Name.	Age.	Colour.	Reason for Rejection.	Owner.
Byron	4	Bay ..	Curb and L.C.	J. H. L. Parfitt, Mount Byron
Eureka Pride	6	Bay ..	L.T. and C...	A. B. Peatey, South Bingera
Flying Denis	6	Bay ..	Curb ..	F. J. Cotter, Goomeri
Gloveman	Aged	Bay ..	L.T. and C...	T. W. Lewis, Moolboolaman
Lord Buzzard ..	5	Chestnut ..	Unicrypt ..	H. N. Ballantyne, Calliope
Midbeau	6	Bay ..	Ringbone ..	R. A. Young, Charleville
Niddala	4	Brown ..	Unicrypt ..	A. Strong, Lismore
Palomond	Aged	Bay ..	L.T. and C...	D. G. Grayson, Killarney
Rex	5	Bay ..	L.T. and C...	E. A. Schroder, Kureelpa
Rivory	5	Bay ..	Spavin ..	H. A. Burnham, Wooroolin
Silver Slip	Aged	Grey ..	L.T. and C...	A. P. Gibson, Boolboonda
Spear Shire	5	Brown ..	Unicrypt ..	L. Clark, Anchor Hotel, Rockhampton
Tieson	5	Bay ..	L.T. and C...	Jande Pastoral Co., Marrawing

PONY STALLIONS REJECTED DURING THE YEAR 1941–42.

Ding Dong	3	Piebald ..	Osteoporosis	C. M. Darlington, Yandaran
Johnnie Walker ..	5	Brown ..	L.T. and C...	A. D. Groves, Bank's Creek, Gympie
Little Jack	Aged	Bay ..	L.T. and C...	H. Richards, Cynthia
Little Jim	Aged	Bay ..	L.T. and C...	J. A. Lewis, Post Office, Warwick
Skipper	3	Bay ..	L.C.	A. J. Tupper, Ramsay street, Toowoomba
Socks	4	Bay ..	L.T. and C...	K. J. Widderick, Acland
Starlight	6	Bay ..	L.T. and C...	D. S. Plant, Cabarlah

TROTTER STALLIONS REJECTED DURING THE YEAR 1941–42.

Condamine	3	Black ..	Curb ..	A. D. Knox, Belmont
Home Boy	6	Brown ..	L.S.T. and C.	L. Palmer, Kensington Estate, Bundaberg

DRAUGHT STALLIONS REJECTED DURING THE YEAR 1941–42.

Bowler	Aged	Bay ..	L.T. and C. ..	W. L. Gleeson, Pozieres
Bullyard Prince ..	4	Black ..	S.B. and Unicrypt	Alexander and Sons, Sharon, Bundaberg
Donald	5	Bay ..	L.T. and C. ..	F. Graham, Blair Athol
Glenbar Barron Kerr	6	Bay ..	S.B.	A.M.L. and F. Co., Retro, Clermont
Punch	4	Bay ..	L.T. and C. ..	A. W. Skewes, Marlborough
Royal Add	5	Bay ..	S.B.	W. T. Gillies, Cooyar
Royal Tenor	4	Black ..	L.C.	S. Otto, Bum Bum Creek, Crow's Nest

CHANGES OF ADDRESS.

Subscribers are asked to kindly notify changes of address to this Department without delay.

General Notes

Staff Changes and Appointments.

Dr. J. Legg, D.V.Sc., M.R.C.V.S., Senior Veterinary Surgeon, Animal Health Station, Yeerongpilly, has been appointed Director of the Animal Health Station, Yeerongpilly.

Mr. P. C. Boettcher has been appointed assistant cane tester at the Isis mill for the remainder of the sugar season.

Mr. W. Ney (Strathalbyn, Collinsville) has been appointed an honorary protector of fauna in place of Mr. W. Sievers.

Messrs. J. R. Bailey (Curator of Parks and Gardens, Toowoomba) and J. V. Scanlan (Toowoomba) have been appointed honorary protectors of fauna.

Dr. J. Legg, D.V.Sc., Director, Animal Health Station, Yeerongpilly, has been appointed a member of the Veterinary Medicines Board in the place of Mr. J. A. Rudd, retired.

Mr. E. F. Tree (Currumbin) has been appointed an inspector under "*The Diseases in Plants Acts, 1929 to 1937,*" and an agent under "*The Banana Industry Protection Acts, 1929 to 1937,*" Department of Agriculture and Stock.

Messrs. C. Schindler and E. J. Lorraine, inspectors under *The Diseases in Plants Acts,* have been transferred from Wallangarra to Moorooka, and from Moorooka to Wallangarra, respectively.

All inspectors under *The Diseases in Stock Acts, The Slaughtering Act,* and *The Dairy Produce Acts* have been appointed also inspectors under *The Diseases in Poultry Acts,* Department of Agriculture and Stock.

Messrs. A. A. Ganter and H. W. Tucker (Yeppoon) have been appointed honorary rangers under *The Native Plants Protection Act* and honorary protectors of fauna.

Mr. A. Corcoran, Head Teacher, Allan State School, near Warwick, has been appointed an honorary protector of fauna.

Constable V. D. Mant (Croydon) has been appointed also an inspector under *The Slaughtering Act.*

Mr. L. M. Hodge, manager, Callide Cotton Research Farm, Biloela, has been appointed acting senior instructor in cotton culture, Dalby.

Mr. W. A. R. Cowdry, instructor in cotton culture, has been appointed acting manager, Callide Cotton Research Farm, Biloela.

Mr. A. W. S. May, assistant to research officer, has been transferred from Nambour to Gayndah.

The following inspectors of workers' accommodation have been appointed also inspectors under the *National Security (Emergency Supplies) Rules of* 1941 for the purpose of policing the Rule relative to the provision of reserve stocks by employers for the districts opposite to each:—

Mr. G. W. Jackson—Balonne, Bendemere, Booringa, Bungil, Murweh, Roma, Taroom, Warroo.

Mr. D. B. Wilson—Barcoo, Bulloo, Charleville, Paroo, Quilpie, Tambo.

Mr. J. J. M. Manski—Aramac, Barcaldine, Bauhinia, Belyando, Blackall, Emerald, Ilfracombe, Isisford, Jericho, Longreach, Peak Downs.

Mr. J. C. Perrett, Boulia, Diamantina, Dalrymple, Flinders, Hughenden, Wyangarie, Winton.

Mr. O. Duffy—Barkly Tableland, Burke, Carpentaria, Cloncurry, Croydon, Mackinlay.

Mr. W. C. Toohey—Cook, Etheridge, Woothakata.

Mr. E. J. L. Clarke—Wangaratta.

Fruit Marketing.

Regulations under *The Fruit Marketing Organisation Acts* have been amended to provide for optional preferential voting in respect of the election of members of sectional group committees.

Close Season for Snipe.

An Order in Council issued under *The Fauna Protection Act of* 1937 varies the period of close season for the Australian Snipe from 1st October in each year to 30th April in the following year to 15th February to 14th November in each year, inclusive, throughout Queensland. This, in effect, means that the open season for snipe extends from 15th November in each year to the following 14th February, both inclusive.

State Wheat Board.

The election of four growers' representatives on the State Wheat Board resulted in the return of the present members. The voting was—W. J. Brimblecombe, Pirrinuan, 1,023 votes; T. W. McIntyre, Yarranlea, 978 votes; A. C. V. Bligh, Condamine Plains, Brookstead, 919 votes; J. G. Tod, Yandilla, 913 votes; and W. J. Daly, Wiyarra, 447 votes.

The new Board will be appointed for a term of three years.

Bingera Mill Levy.

Regulations issued under *The Primary Producers' Organisation and Marketing Acts* empower the Bingera mill suppliers' committee to make an additional levy for administrative purposes, at the rate of ½d. per ton, on suppliers of sugar-cane to the Bingera mill.

Control of Stickfast Flea.

Following the appearance of the Stickfast Flea of poultry on certain properties in the Kalbar-Teviotville district, an Order in Council has been issued under *The Diseases in Poultry Acts* declaring the poultry districts of Boonah and Normanby to be an infected area for the purposes of the Acts.

Regulations also have been issued which will cover the movements of poultry within or without such infected area.

For the purpose of providing adequate supervision in connection with this outbreak, the following appointments have been made:—

Messrs. J. C. J. Maunder, A. R. Nott, and A. F. S. Ohman, Government veterinary surgeons; L. G. Newton, assistant to veterinary surgeons; and E. T. Lewin, inspector of dairies, Boonah, have been appointed also inspectors under *The Diseases in Poultry Acts.* Mr. A. W. McLauchlan, field assistant (poultry), has been transferred from Brisbane to Boonah.

Cheese Board.

The following have been nominated for appointment as members of the Cheese Board:—

Messrs. T. Dare (Woodleigh), R. C. Duncan (Pittsworth), M. McIntyre (Mount Tyson), D. G. O'Shea (Southbrook), R. W. Thomas (Toowoomba).

An election, closing at 12 noon, will be held on 2nd December, 1941. Three members are required.

National Security.

An amendment of the *National Security (Emergency Supplies) Rules of* 1941 provides that the period for which bread improver is to be stored shall be four weeks instead of six weeks.

Noxious Weeds.

The following weeds have been declared noxious weeds throughout Queensland:—

African Box Thorn (*Lycium afrus*); Buthurst Burr (*Xanthium spinosum*); Blackberry (*Rubus fruticœus*); Cape Spinson (*Amex Australia*); Coca Leaf (*Erythroxylon coca*); Finger Cherry (*Eucdomyrtus macrocarpa* Benth.); Flannel Weed (*Sida cordifolia*); Green Cestrum (*Cestrum parquii*); Groundsel Bush (*Baccharia halimifolia*); Indian Hemp (*Cannabis sativa*); Khaki Weed (*Alternesthera schyrantha*); Mint Weed (*Salvia lanceifolia*); Mist Flower (*Eupatorium riparium*); Needle Burr (*Amarantus spinesu*); Noogoora Burr (*Xanthium strumarium*); Onion Weed (*Asphodelus fistwicaus*); Opium Poppy (*Popover couniferum*); Patterson's Curse (*Echium plantagineum*); Prickly Poppy (*Argemena mexicana* var. *orchreleuca*); Rubber Vine (*Cryptostegia grandiflora*); Saffron Thistle (*Carthamus lanatus*); Variegated Thistle (*Silybum marisnum*); Balloon Cotton or Cape Cotton (*Gomphocarpus fruticosus* and *Gomphocarpus physocarpus*).

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Queensland Botanist, Mr. **"Flaveria."**

A Thorn Apple.

D.G.O'S. (Toowoomba)—

Your specimen is *Datura ferox*, a species of Stramonium or Thorn Apple, a native of Southern Europe, now a very common naturalised weed in parts of Queensland, especially on the Western Darling Downs. So far as we know, it first made its appearance about Macalister about twenty years ago or more, but now has become very widespread, particularly during the past few years.

Practically all species of Datura or Stramonium are poisonous to stock, although, fortunately, they are not often eaten in the green state. The chief trouble occurs when the plants are present as weeds in cultivation, and are chaffed along with the standing crop. They are sometimes eaten with impunity, but the danger is always there.

Plants from Blackall District Named.

E.M.B. (Yaraka)—

1. *Eragrostis xerophila*. An excellent sheep grass. One of the love grasses, and, along with several others, commonly called Never Fail or Never Tire.
2. Cannot be sure of this grass from the butt alone. Could we possibly have a specimen later on with seed heads?
3. *Diplachne Muelleri*. An excellent fodder. Your local name Mulga Couch is noted with interest.
4. There is a bit of a mixture here; a piece of one of the blue grasses, also of Wild Millet (*Echinochloa Turneriana*), a remarkably good fodder on the flooded country.
5. *Eulalia fulva*, Brown Top. The value of this grass seems to vary a good deal from district to district, and according to class of country. The form you send is rather a coarse one, which commonly grown on the flooded country.
6. *Neurachne Mitchelliana*, Mulga Grass; an excellent fodder in mulga country.
7. *Aristida latifolia*, one of the 3-pronged spear grasses.
8. *Aristida Muelleri*, a spear grass with a much softer seed than most of the others, and apparently quite a good fodder.
9. *Aristida arenaria*, a bad spear grass.
10. *Eragrostis setifolia*, one of the love grasses. This, and one or two other species that grow on flooded country, are commonly known as Never Fails, or Never Tires, and are an excellent feed for sheep.
11. *Themeda avenacea*, Oat Grass. As you say, this grass possesses a very obnoxious seed. It is closely allied to Kangaroo Grass.
12. *Eragrostis laniflora*. It is closely allied to Nos. 1 and 10.
13. *Trianthema portulacastrum*, commonly known in Queensland as the Black Pigweed or Hog Weed. It is a native of tropical America, that has been established in Queensland now for about twenty years. It has become a very serious pest in some of our farming areas, particularly on the cotton fields of the Callide Valley.

Carob Bean.

R.G.B. (Hughenden)—

Our supply of Carob Bean (*Ceratonia siliqua*) seeds is now exhausted, because of very heavy demands, so that if you want further seed for trial you would have to get it from a Southern source. Messrs. Law, Sumner, and Company, seedsmen, Melbourne, advertise seed at 1s. 6d. per packet.

Shade Trees for the Nor'-West.

R.G.B. (Hughenden)—

Portuguese Elm (*Celtis sinensis*).—This tree is worth trying in your locality, and the leaves are excellent fodder for stock. The demand for seed has been very heavy this year and we have only a few left. These, however, have been sent you. If sown in an ordinary garden bed, they transplant very easily, especially in the late spring, and if kept watered when newly planted out.

Following are further suggestions:—

Kurrajong—seed can be obtained from Messrs. A. Murphy and Sons, Woy Woy, New South Wales.

Bottle Tree, both broad- and narrow-leaved varieties. Seed of the former, which does remarkably well in North-Central Queensland, can be obtained, we think, from the Curator, Botanic Gardens, Rockhampton. The narrow-leaved variety could probably be obtained from Roma or Dalby.

Trees already growing in your area and which are doing remarkably well are:—

Parkinsonia—prickly, but makes a handsome tree when well looked after, but sometimes inclined to run out and become somewhat of a pest.

Acacia—the tree commonly called "Acacia" in Western Queensland is *Albizzia Lebbeck*. It is rather subject to borer attack.

White Cedar, Pepper Tree.

Bauhinia—the native Bauhinia does remarkably well, but is of rather slow growth.

Phytolacca dioica, the Phytolacca or Bellasombra Tree, is a tree worth trying. You could obtain seed from Mr. R. Dick, Purga, price 2s. per large packet.

The Forestry Department supplies trees to farmers and pastoralists at the very reasonable rate of 5s. 6d. per dozen for tubed plants. Among the trees distributed and which we think would do well in your district, or which are at least worthy of trial, are:—

Western Cypress, Crow's Ash, Loblolly or other Pine, Mexican Cypress or Arizona Cypress.

If you are interested, get in touch with the Secretary, Forestry Sub-Department, Executive Buildings, Brisbane.

Johnson Grass.

C.E.F. (Goomeri)—

The specimen is, as you suspect, Johnson Grass (*Sorghum halepense*), a native of the Mediterranean regions, now widely spread in most warm temperate and subtropical countries. The plant is poisonous to stock since, like most other sorghums, it contains a prussic-acid-yielding glucoside. Ordinary paddock stock, however, have been fed on the grass with impunity. Most of the trouble has been where hungry animals have been allowed to eat the grass freely on an empty stomach. If cut and allowed to wilt before feeding, the danger from poisoning is considerably lessened.

As in all plants with an underground food storage system, all attempts at eradication should be aimed at keeping down the leaf growth by cutting or mowing, as in this way the stored food is gradually used up.

Duck Weed.

E.M.H. (Ashgrove)—

The specimen represents the Duck Weed (*Lemna minor*). This plant propagates very quickly by vegetative means, and soon covers the surface of a pond. Raking is generally the best method of getting rid of it. It sometimes tends to die out in the hot weather. Raking over the surface of the pond, if done regularly, should keep the plant in check, but as you say you have done this, you could try spraying with commercial sprays. Copper sulphate, ½ lb. to 10 gallons of water, sprayed evenly over the surface, is recommended. If you prefer, you could use Bordeaux mixture, which you can obtain already made up in tins from most nurserymen. It is a fungicide, and in spraying aquatic weeds it should be used only half the recommended strength of the tins.

Rural Topics

Guarding Britain's Farm Lands from Fire Bombs.

With about 13,000,000 acres now under the plough this spring—nearly 4,000,000 more than in 1939—Britain's farmers made elaborate plans to protect their grain crops from fire bombs.

Last year Germany's air onslaught did not develop fully until the harvest was gathered in, but this year things were different, and the menace to British food supplies was very real.

This is what the British farmers did: They cut firebreaks or lanes, about 30 feet wide, across the direction of the prevailing wind. The crops, cut green, were not wasted, but were made into hay or silage. Corn stooks were protected by setting the rows as far apart as possible. Haystacks were set at least 15 yards apart, and preferably out in the field, to prevent enemy landings.

For dealing with outbreaks of fire, water carts were kept filled near the standing crops, and further reserves stored in handy places.

Fire fighters had stirrup pumps, fruit-spraying machines, liquid-manure carts, and fire-beaters all ready for instant action. Tractors were useful for ploughing a firebreak quickly in the path of advancing fires and scythes for isolating small patches.

With fire-watchers, A.R.P. wardens, and Home Guards in every parish, there was no lack of man-power to safeguard the vital harvest of 1941.

The Stickfast Flea—Another Pest Importation.

It is a remarkable thing that most of Australia's pests, both animal and vegetable, have been imported in one way or another—some deliberately and thoughtlessly, others accidentally in packing material and by other means. Once Australia, by reason of comparative isolation and distance from other lands had some immunity from the risk of pest invasion—a sort of natural quarantine period. To-day, however, with speedy transport, especially by air, much of that natural immunity no longer exists. So it is easy to understand the alarm felt when the stickfast flea—another imported pest—was reported recently from the Boonah district as infesting a farmer's fowls.

The stickfast flea, what we know of it, was first known as an introduced pest in the Southern States of America and other places with a warm climate. It is smaller than the ordinary flea, and is about one twenty-fifth of an inch in length. It hops like any other flea and just as far. When it finds a suitable place on the body of its host, preferably parts devoid of feathers or fur, it attaches itself firmly to the skin of the host bird or animal, and starts sucking its blood. It sticks to its host like a bank to a security, and that may be why it is called the stickfast flea!

Unlike the ordinary flea—especially the church flea—it is not satisfied with one feed on the one spot. It groups in clusters or colonies and causes the equivalent of tick worry in cattle. So far as we know, it is the sucking of the blood and consequent irritation that causes the worry and leads eventually to the death of the fowl. It also has been found in calves and horses which, however, are apparently not seriously affected by it. But on smaller animals—dogs, cats, and wallabies, chickens, pigeons, and other birds, it can become serious in its effects and spreads more rapidly and widely.

Another unusual thing about the stickfast flea is that it doesn't leave its host to lay its eggs. When laid, its eggs drop off and are hatched in the droppings of the host animals. So, obviously, one of the most effective ways of preventing its spread is to keep fowlhouses, yards, and other premises clean; and where infestation has occurred, all manure and litter should be completely destroyed. Water, it is believed, will destroy the larvæ, so, if that is proved, immersion—that is complete immersion—of manure in water for a reasonable time would be effective, and the value of the manure as a fertilizer retained. But it is no use just sprinkling or lightly soaking the manure, for that would simply aid both the hatching of the eggs and the development of the larvæ, and so perpetuate infestation of the flea. Sandy soil, as with other fleas, is a very effective breeding ground of the stickfast flea pest.

The stickfast flea has been found in other parts of Australia, but not previously in Queensland.

Insect Pests as a Fifth Column.

It doesn't happen, of course, in these days of strict petrol rationing, but when we were able to speed along the Pacific Highway to Sydney and other places in other States, we all had that feeling of temporary annoyance—unreasonable as it was—when pulled up by vigilant quarantine inspectors with the query—"Any plants or flowers in your car?" Why the fuss—a harmless plant in a pot isn't a bomb. That's right, but, all the same, it might harbour an insect pest that would kill more fruit trees than an October bush-fire, and so destroy more food than a whole "stick" of bombs.

The fact is that we have an insect fifth column which is ceaselessly sabotaging the economy of the State—hence these roadside inspections and the vigilance of our fruit inspectors at the Border.

Over in the United States, Government entomologists have estimated that insect pests cost that country over 1,600,000,000 dollars—roughly £300 millions in our money—every year, or the equivalent of the services of a million men. And, as in Australia, most of the serious pests affecting the farming industry were imported—that is they entered the country in various ways—in introduced plants, packing material, and so forth.

Mosquitoes head the list, with the cotton boll weevil second. Then come the corn earworm, the housefly, and the rice weevil.

Like Australia, for pests, America is a land of opportunity. Of the fifty worst insect pests, about a third have come from other countries. They came as stowaways on ships and aeroplanes. They came hidden in straw, in fertilizing material, and in plants and flowers. In fact, in Queensland, some of our most serious pests of sugar-cane have been brought in with new cane plants by some smart canegrowers who, in the earlier days of the sugar industry, thought they were clever in dodging quarantine inspectors with their cane plant importations.

In spite of the most careful quarantine, new pests may be introduced. So when any unfamiliar pest is discovered we should immediately let the Department of Agriculture and Stock know all about it. That's what the Boonah farmers did when they found the stickfast flea in their poultry flocks. As a result, the alert men concerned got busy without a moment's delay to isolate, if possible, the area of infestation.

How important this action is can be understood when we remember that the destructive Japanese beetle was unknown in the United States before the first world war. It apparently came with a cargo from overseas. The elm bark beetle, which causes the dreaded Dutch elm disease, was brought to America in the wood of a crate containing English china. Larvæ of a small injurious moth were found in a string of beads made of seeds from Italy.

The Hessian fly is believed to have arrived from Europe in straw used as bedding by Hessian troops who fought in the American revolution. The Hessian fly soon did far more damage than the Hessian troops themselves.

The Argentine ant—which was discovered in Victoria some time ago and promptly exterminated, may have come in coffee from South America.

Of course, every insect pest is not harmful, and many are beneficial. For instance, the Australian lady bird was sent to California to combat the cottony-cushion scale in citrus orchards. In return, we got the cactoblastus, which freed Queensland from the prickly-pear curse. At Boonarga, farmers have built a memorial to the cactoblastus.

All the same, there is need for eternal vigilance where insect pests are concerned, and it is still a question as to who will inherit the earth—Man or Bug.

Types of Soil.

A sandy soil is described as light, and sandy and loamy soils are spoken of as open and free-working. Friable soils are readily crumbled between the thumb and fingers. A clay soil is described as heavy because it is sticky and tenacious; it may also be termed stiff or stubborn. A "mellow" soil is one which by natural or artificial means is reduced to a fine state of subdivision of the particles. A "hungry" soil is one that is greedy of manure and water with little power of retaining either a poor sandy soil for example. A "cold" soil contains an excess of clay or humus, both of which retain water. A "shallow" or "thin" soil is one in which the distance from the surface to the subsoil is but little. A "deep" soil, such as many clays, is of considerable thickness. For nearly all purposes loams make the most suitable soils.

Farm Notes

DECEMBER.

EARLY-SOWN crops of sweet sorghums, sudan grass, millet, and maize, intended for fodder purposes, will now be in an advanced stage of growth where seasonal conditions have been favourable. Every effort should be made, where practicable, to conserve any surplus growth in the form of silage, hay, or stover. Trench, pit, or stack silage is recommended as economical and profitable means of conservation where an overhead concrete silo is not available. However, it is the autumn-harvested crops which usually provide the greatest bulk of conserved fodder; so December sowings of suitable bulky summer fodder crops are best for that purpose.

In localities where lucerne does not make satisfactory growth, the cowpea will often provide an alternative protein-rich fodder, besides being a valuable rotation crop of benefit to the soil. Cattle will not take readily to green cowpea, preferring the fodder in an advanced stage of growth, but once accustomed to it they will graze freely on it.

Sowings of main-crop maize will be continued during the month where conditions are suitable, utilising late-maturing varieties such as Improved Yellow Dent; but in districts where early frosts are experienced, the mid-season or early varieties are preferable.

Buckwheat is recommended as an early maturing alternative fodder crop, or as green manure where it is desired to plough under within six to eight weeks. Besides being a good fodder, buckwheat is valued as a bee plant, while the seed makes excellent poultry feed. Wheat-harvesting will be practically finished this month. Growers are, therefore, advised to give the land a preliminary working immediately after the burning or grazing of stubble in order to conserve succeeding summer rains. Even where the land is too hard for adequate ploughing, a light working with disc cultivator or sundercut will be found very beneficial.

Experience in recent years has proved that adequately summer-fallowed land invariably produces profitable yields.

December is usually a busy month, because of successive sowings of fodder and grain crops and the scarifying of row crops already established.

Plate 157.
AUTO-HEADERS AT WORK, SOUTHERN DARLING DOWNS.

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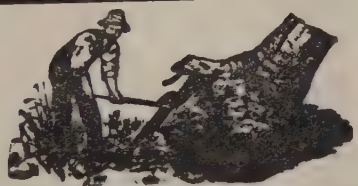

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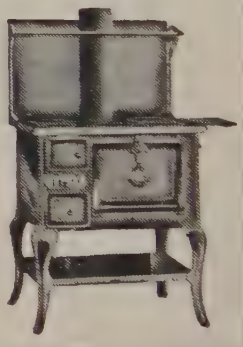

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Make YOUR Will NOW . . . and name as your Executor and Trustee—

The PUBLIC CURATOR
BRISBANE, ROCKHAMPTON, TOWNSVILLE, CAIRNS.
Agents — Any Local Clerk of Petty Sessions

Orchard Notes

DECEMBER.

THE COASTAL DISTRICTS.

PLANTING of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young, they take a long time to recover and consequently the fruiting period is considerably retarded.

Citrus orchards require constant attention; the land should be kept well worked and all weed growth destroyed. Spraying for scale insects should be done where necessary.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and lemons will be in season during the month.

Examine potatoes and tomatoes for Irish blight, and melons and kindred plants for downy and powdery mildew. Use bordeaux or burgundy mixture for Irish blight and downy mildew and sulphur dust or lime sulphur spray for powdery mildew.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS. THE COASTAL DISTRICTS.

EARLY-ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle. The season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. Early ripening fruits should be carefully graded for size and quality, handled and packed with great care, and nothing but choice fruit sent to market.

Orchards and vineyards should be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later-ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, unless, of course, there is a good fall of rain in the meantime.

Codling moth and fruit-fly regulations should be observed strictly in order to keep these pests under control; otherwise the later-ripening fruits are likely to be attacked severely by these pests.

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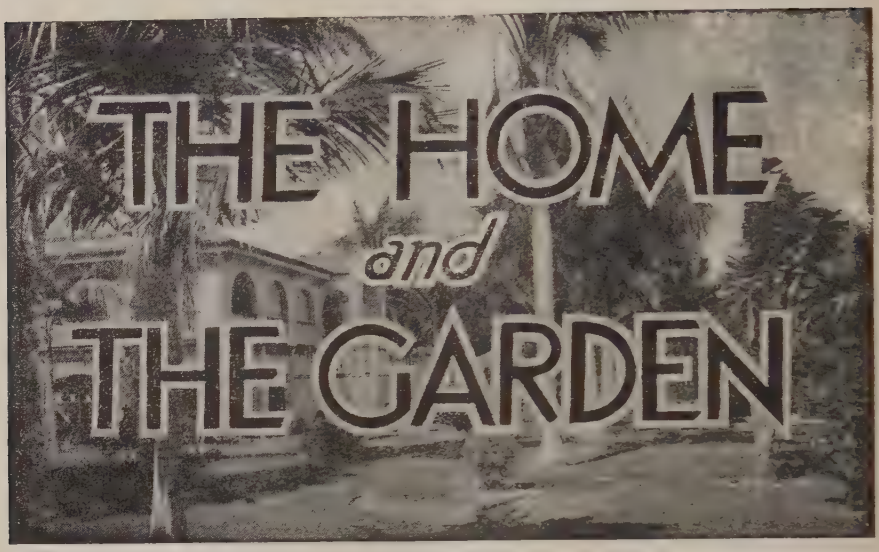

Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

BABY'S HEALTH: NATION'S WEALTH.

CHILDREN'S EYES.

WE have chosen "eyes" as the subject for our talk this month, because the present craze for dressing little girls in the fashion of child film stars has resulted in much unconscious cruelty to tiny tots who have been forced to go about the streets in the brilliant sunny weather of Queensland with nothing on their heads but a large bow of ribbon. Several times in the last few days I have seen mothers, themselves protected by the shadiest of hats, dragging by the hand small bareheaded boys or girls whose eyes were painfully screwed up in an effort to secure protection from the glare.

Tiny babies are equal sufferers, not because they are taken out without hats, but because their head covering is confined to a small brimless bonnet which leaves their eyes exposed to the full rays of the sun unless mother carries a sunshade.

It may help mothers to understand advice on the care of the eyes if we "begin at the beginning" and consider baby's eyes from birth onwards.

The Development of Sight.

The newly-born infant avoids the light, and the eyelids will be seen to close if he is taken into a strong light. Continuing during the first few weeks of life, the behaviour of the infant indicates that excessive light is unpleasant. Therefore the room in which a newly-born infant is placed should be darkened, and for the first few weeks the eyes should be protected against strong light.

It will be noted that gradually the eyes become accustomed to light, and baby will turn his head and follow a light in a room. As he becomes older he shows distinct signs of pleasure if a brightly-coloured object is held before him. By the time baby is three months old he should be able to recognise his mother, although it may be her smile rather than her features to which he responds. By the age of six months he should be able to recognise many familiar things, although it is some time before he is able to gauge their distance from him.

To test a baby's power of seeing, we should watch and note whether his eyes will follow a moving light or a bright object. His vision may also be tested by bringing the point of a finger close to the open eyelids and observe whether it makes him blink. This may not cause blinking in a normal baby under two months old.

During the first few weeks of life the surface of the eye is not very sensitive, and water may be splashed on it without causing blinking. The eyelids of the young baby move irregularly and are often faintly separated during sleep.

Muscular Development.

As we have explained in other lectures, the muscles of the body are so grouped that by their pull one against another the various structures are kept in their proper position. This is not so at first in the case of baby's eyes. The muscles of the eyes of the newly-born baby do not work in harmony. It is not until baby is three months old and even older that any co-ordination of these muscles occurs, so that very young babies often appear to have a slight squint.

However, if an older child squints it may be due to a definite defect in the working of the eye muscles or to unequal vision in the eyes themselves, and the child should be taken for advice to a hospital or an eye surgeon. A squint may also be the first sign of lead poisoning, and therefore mothers should always pay attention to the appearance of a squint.

Discharging Eyes.

Not uncommonly, infants suffer from a "watery eye," and a bead of matter collects each morning at the inner corner of the eye. This is usually due to a blocking or narrowing of the lower end of the tear duct which normally conducts tears from between the lids into the nose, where they evaporate. The obstruction may be removed by carefully applying pressure with the tip of the little finger to the skin surface of the inner side of the eye. This should be done several times each day. If the troubles does not improve within a month or so, medical advice should be sought.

The eyes of the newly-born infant may become inflamed as the result of infected matter getting into them during birth. In order to prevent this, the attending doctor or nurse cleans baby's eyes with a special lotion immediately baby is born. If at any time after leaving hospital mother notices redness or swelling of baby's eyelids or a mattery discharge, she should take baby to a doctor as soon as possible. If the lids of an inflamed eye stick together, do not attempt to separate them with your fingers, or the delicate surface of the eye may be injured and cause the inflammation to spread to deeper parts. With the aid of a piece of clean cotton-wool or soft, white boiled rag gently bathe the lids from the inner to the outer side of the eye, using warm boiled water. Never use the same piece of wool twice.

The discharge from an inflamed eye may infect the eyes of other people in the house, and so the greatest care must be used not to carry infection by fingers, washers, towels, &c., to baby's other eye or to other persons. Everything used for the baby must be kept separate, and mother must wash her hands very thoroughly with soap and water immediately after attending to baby's eye as well as before.

Protection from Glare.

All babies and children should wear hats or bonnets with a broad brim during very sunny weather. Perambulators should have unlined wicker hoods, and in the case of an infant carried in the arms the baby should be so turned that its eyes are shielded from the sun.

Backwardness and Defective Vision.

A child who is backward or appears to be slow in learning anything should have his eyes as well as his ears examined. Defective sight or hearing may make a child appear dull.

Care of Sight.

When the child reaches the age when he is reading and writing, care should be taken that the light falls upon the page without causing glare. At school the blackboard should be placed so that proper illumination is secured. If the board is placed to one side of a window which a child is directly facing, the glare may make it difficult for him to see the board.

Cleansing the Eyes.

In dusty, dry weather, particularly in the western districts, it is advisable to bathe the eyes frequently with warm salt and water (one teaspoon to one pint) or with boracic lotion (one teaspoon boracic acid to one pint water). The eyes should be protected from flies.

Foreign Body.

The surface of the eye is very sensitive and delicate and can be easily injured; therefore great care must be exercised in attempting to remove any foreign particle. A drop or two of castor oil may be instilled into the eye, and this may cause the particle to come away. If you experience any difficulty, do not persist, but consult a doctor. Should a speck of dirt get into the eye, examine the eye at once, drawing the lower lid downwards. If nothing can be seen, draw the upper lid over the lower. Ask the child to look towards his toes. If the speck is visible, remove it with the corner of a clean handerchief or a wisp of cotton-wool.

You can obtain information on this or any other matter relating to the feeding and management of children up to school age by writing to "Baby Clinic, Brisbane." Such letters need not be stamped.

IN THE FARM KITCHEN.

CHRISTMAS PUDDINGS AND SAUCES.

Christmas Pudding.

Take ½ lb. suet, ½ lb. raisins, ¼ lb. flour, ¼ lb. currants, ¼ lb. peel, ¼ lb. sultanas, 1 oz. almonds, grated rind, ½ lemon, 2 tablespoonfuls golden syrup, 2 eggs, ½ gill milk, ¼ nutmeg (grated).

Prepare the fruits. Chop the suet. Mix the flour and suet together. Add the lemon rind, nutmeg, and prepared fruits. Cut the peel into small pieces, blanch the almonds and cut into pieces. Add these to the other ingredients and mix well. Whisk up the eggs, add the golden syrup, and whisk together. Put into a greased basin, cover with greased paper and floured pudding cloth. Put into a saucepan of boiling water and steam for eight hours. Turn on to a hot dish and serve.

Children's Christmas Pudding.

Take ¾ lb. grated beef suet, 1 lb. breadcrumbs, ¼ lb. fine flour, ¾ lb. raisins (stoned and chopped), ¼ lb. sultanas, grated rind and juice 2 oranges, ½ teaspoonful salt, 4 eggs, ½ lb. golden syrup, ½ pint milk.

Mix the dry ingredients first, warm the syrup, and mix with the beaten eggs and milk, add the strained orange juice; then work the whole into a stiff paste very thoroughly. Keep over for two days, mix again, then put into two well-greased moulds, tie down securely, and boil for four hours. Boil for another hour when going to use the puddings. A few blanched and split almonds should decorate the puddings when turned out of the moulds.

Rich Christmas Pudding.

Take 1 lb. finely chopped suet, 1 lb. brown sugar, 1 lb. stoned raisins, 1 lb. currants, ¼ lb.candied peel (cut in thin slices), ½ lb. flour, 8 oz. breadcrumbs, 8 eggs, 3 oz. almonds (blanched and shredded), 1 saltspoonful grated nutmeg, 2 teaspoonfuls baking powder, grated rind of 1½ lemons, 1 teaspoonful salt, about ½ pint milk, 1 gill brandy.

Thoroughly mix together all the dry ingredients, then stir in the eggs, which have been well beaten; add gradually the milk and, lastly, the brandy. This quantity will make four good-sized puddings. Place in buttered moulds or basins, and steam for five hours. When needed for table, steam another two hours. Serve with any sauce which is preferred.

Christmas Pudding.

Take 3 oz. flour, 6 oz. suet, 3 oz. breadcrumbs, 6 oz. stoned raisins, 6 oz. currants, 4 oz. minced apple, 3 eggs, 5 oz. sugar, 2 oz. candied peel, ½ teaspoonful spice, 1 small wineglassful brandy, pinch of salt, ½ teaspoonful nutmeg.

Mix together the flour, breadcrumbs, chopped suet, raisins, currants, minced apples, sugar, peel (minced small), nutmeg, spice, a pinch of salt, the brandy and whole eggs. Mix and beat these ingredients well together, pour them into a well-buttered mould or basin, spread a buttered paper over, then tie a cloth firmly over the top. Boil for four hours, keeping the pudding well covered with boiling water, then turn it out, sift icing sugar thickly over the top, pour two or three tablespoonfuls of brandy round, and, just before serving, set it alight. This pudding may be served with wine or punch sauce, or with rum or brandy butter.

Individual Christmas Puddings.

Take 4 oz. suet, ½ lb. raisins, ¼ lb. currants, 2 oz. sultanas, 2 oz. candied peel, 1 oz. shelled walnuts, 4 oz. sugar, 3 oz. breadcrumbs, 1½ oz. flour, grating of nutmeg, ¼ flat teaspoonful ground cloves, 2 eggs, ½ gill rum.

Wash, pick over, and dry the fruits and stone the raisins. Shred the candied peel and chop up the walnuts. Sieve the flour with the spices, add the finely-chopped suet, and the breadcrumbs, then stir in the sugar, prepared fruits and nuts, and mix all together. Whisk the eggs and add them. Moisten the mixture with the rum and some milk as required. Beat it well and leave it to stand overnight, adding more moisture after that time, if necessary. Turn the mixture into six buttered moulds. Cover them securely with buttered papers and steam them for about an hour and a-half or two hours. Unmould the puddings and serve them with half a shelled walnut on each.

WATERING IN DRY WEATHER.

DR. D. A. HERBERT.

IN periods when the water supply is restricted it is more than ever desirable to see that what water is put on the garden is used to the best effect. It is very easy to waste a lot of time sprinkling garden beds and yet to get very little benefit, and this applies especially when an attempt is made to get round the whole of the garden in a limited time. These quick waterings moisten the surface of the soil and the leaves of the plants, but do not penetrate far down. The deeper layers, where the roots are, may not get any benefit, and because the top layers are moistened regularly the roots tend to come to the surface where they are in great danger of drying out, or of being injured by the heat of the sun.

The best plan is to work out a routine of watering and to see that each bed gets a good soaking from time to time, instead of frequent sprinklings. Where it is not possible to give a weekly soaking, individual plants may be tended by making a small earth-wall round the base and filling up the depression two or three times with water as the soil becomes dry.

The amount of water that a plant can use depends, of course, on the plant. A tree may get rid of gallons of water every day, but an ordinary garden plant, like a dahlia, may use little more than a pint or so each day, and the amount is correspondingly smaller for, say, a strawberry plant. If we accept that about six gallons a month is the water ration for a maize plant, we might, perhaps, conclude that all that is necessary is to give it a kerosene tin and a-half each month. The trouble is that all the water put into the soil is not used by the plant. Some of it never gets near the roots, but the most serious loss is by evaporation from the soil. The surface of the soil dries out very quickly in dry weather. For water economy, therefore, this source of loss has to be cut down, so that more of what is put in will be available to the roots. A mulch of dead leaves, cut grass, or animal manure is useful for the purpose. It protects the soil from drying out, and when later the bed is dug over it can be incorporated in the soil to improve its texture. Where it is not possible to obtain enough material to make a mulch the scuffling up of the surface of the soil with a hoe is an aid to moisture conservation.

One further recommendation is to avoid sprinkling leaves in dry weather. Wet leaves actually lose more water than dry ones, and often the roots cannot keep up a sufficient supply, though perfectly capable of doing so if the leaves are kept dry. It is often noticed that plants wither suddenly after rain, and though this may be the result of fungal attack, it is often due to the fact that the rain-wetted leaves are losing water too fast for the roots to supply the deficiency. It is very doubtful whether overhead sprinkling is of much use except in so far as much of the water so given finds its way into the soil. The amount actually absorbed by the leaf is not great, and has the disadvantage mentioned, it induces the leaf to give off its water supply more rapidly.

The remark that a good shower of rain is better than any amount of hosing or hand watering has an arithmetical basis. An inch of rain on an average small garden might be the equivalent of 5,000 gallons of water, and it is not surprising that it gives better results than ordinary hosing, apart from any considerations, such as hardness of the water supply. It might be pointed out, too, that an occasional good shower is much more beneficial than more frequent light sprinkles that moisten the surface only, which brings us back to the point from which we started.

ASTRONOMICAL DATA FOR QUEENSLAND

DECEMBER, 1941.

By A. K. CHAPMAN, F.R.A.S.

SUN AND MOON.
AT WARWICK.

Dec.	SUN.		MOON.	
	Rises.	Sets.	Rises.	Sets.
	a.m.	p.m.	p.m.	a.m.
1	4.48	6.34	4.14	3.6
2	4.48	6.35	5.5	3.43
3	4.48	6.36	5.56	4.23
4	4.48	6.37	6.47	5.4
5	4.48	6.38	7.37	5.49
6	4.48	6.38	8.24	6.36
7	4.48	6.39	9.10	7.26
8	4.49	6.39	9.53	8.18
9	4.49	6.40	10.36	9.11
10	4.49	6.40	11.16	10.6
11	4.49	6.40	11.55	11.2
12	4.49	6.41	nil	12.0
			a.m.	p.m.
13	4.50	6.41	12.34	12.59
14	4.50	6.41	1.16	2.1
15	4.50	6.42	1.59	3.5
16	4.51	6.43	2.46	4.11
17	4.51	6.44	3.36	5.18
18	4.52	6.45	4.33	6.24
19	4.52	6.46	5.33	7.26
20	4.52	6.46	6.35	8.22
21	4.53	6.47	7.39	9.14
22	4.53	6.47	8.41	10.1
23	4.54	6.47	9.40	10.42
24	4.54	6.48	10.38	11.20
25	4.55	6.48	11.33	11.56
			p.m.	
26	4.55	6.49	12.26	nil
				a.m.
27	4.56	6.49	1.18	12.31
28	4.57	6.50	2.10	1.7
29	4.57	6.50	3.0	1.43
30	4.58	6.50	3.51	2.22
31	4.58	6.50	4.42	3.3

Phases of the Moon.

4th December, Full Moon, 6.51 a.m.
12th ,, Last Quarter, 4.48 a.m.
18th ,, New Moon, 8.18 p.m.
25th ,, First Quarter, 8.43 p.m.

ITS GREATEST BRILLIANCY.

THE Evening Star—Venus—claims most of our attention this month, for about Christmas time it will shine with its greatest brilliancy—a brightness so great that no other star or planet ever approaches its splendour. About this time Venus is bright enough to cast distinct shadows upon the earth on moonless nights, in places far from city lights. Unfortunately, the moon will be nearing its full when Venus shines at its brightest. Early in the new year the altitude of the Evening Star will decrease rapidly and its glory fade as it moves in between the earth and the sun. In a small telescope, Venus now appears crescent-shaped, and each evening the crescent will become more slender until in the new year the sun will shine only on the far side of the planet and its night side will be presented earthward.

THE STAR OF BETHLEHEM.

Much has been written about the "Star" which guided the Wise men from the east to Bethlehem on the first Christmas morn. What sort of a heavenly appearance it was is not known. Was it a nova, which shone brightly for a time, and then faded, or a comet, pointing a long ethereal finger to Bethlehem, or a close conjunction of two or three planets? No one will ever know—the gospel story is too brief and vague and the narrator's object was not to teach astronomy. However, there is an ancient tradition that the "star" was none other than Venus, which shone with particular lustre at that time and would be endowed with a similar brilliancy to herald the second coming of Christ.

Every eight years Venus shines with extraordinary brightness. The last time was in 1937, when the planet was the Morning Star. In the late eighteen-nineties such a period of great brilliancy occurred, and some of the country folk in England remembered the old tradition and hailed the brilliant planet as the herald of the second coming of Christ.

On 22nd December the earth will reach that part of its orbit where the sun will reach its farthest south. On that date Old Sol will be overhead at Rockhampton, Longreach, and Emerald, and the shadow of a man will be only as large as the diameter of his belt. After that date the shadow will lengthen as the sun moves northward again.

Mars now crosses the meridian about 8 o'clock and is high in the eastern evening sky at dark. Its fiery red colour has attracted attention during the past few months. The planet was at its best, however, in October, when it was at its nearest to the earth—38 million miles.

Last month Saturn appeared at its best and nearest, it being then 756 million miles away. It is farther away now, but its dull yellow gleam may still be seen a little south of the Pleiades, which rises in the early evening. In a small telescope Saturn appears a long-shaped star; in a larger one its great flat rings are easily seen.

COULD SWALLOW 1,300 EARTHS.

The largest of all the planets is Jupiter, which is 1,300 times as large as the earth. The earth will be passing Jupiter on 8th December, when the planet will be at its nearest—nearly 400 million miles. Jupiter, being in opposition, will rise about sunset and will reach the meridian at midnight. Jupiter is the brightest "star" in the eastern evening sky—it cannot be missed—north of Orion, a little east of Aldebaran in the Hyades. The great astronomer Kepler, who, like many other astronomers, tried to probe into the mystery of the Star of Bethlehem, calculated that about the time of the birth of Christ a very close conjunction of Jupiter and Saturn took place, and they may have appeared as one large star for a short time. Last year, it will be remembered, there was a triple conjunction of these planets, when they passed close to each other no fewer than three times. Even such a rare occurrence as this, however, would not satisfy the conditions stated in St. Math. 2—our only record.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

LOOKING NORTH ABOUT 10 O'CLOCK.

On a clear, moonless night the midsummer sky presents the most magnificent constellations of brilliant stars that can be seen in any part of the heavens. At the present time three bright planets also come within the picture to add still more lustre to the brilliant scene. The beauty and wonder of a starry night has appealed to all at some time or another, whatever their station in life might be.

The stars appear somewhat higher in the sky than shown in the picture, especially north from Warwick. Starting with the Milky Way, we find near the upper edge the famous and well-known starry figure of Orion—the Mighty Hunter, who is mentioned in the most ancient writings. In common with most of the primitive star-figures, Orion is upside-down to us of the south. Therefore, his sword appears hanging upwards from his three-starred belt, which is in the centre of the four bright stars, forming an oblong, which marks his shoulders, left foot, and right knee. Behind the Giant comes his great dogs, Canis Major and Canis Minor. The great, white star near the east corner is Sirius, the Dog Star, the brightest star in the whole heavens. Across the Milky Way is Canis Minor, and its bright star is Procyon. In ancient star maps Orion is shown climbing a hill, so that his left foot is level with his right knee. In his upraised right hand he wields a mighty waddy, and on his left arm is a lion's skin which he uses as a shield. Down the hill charging upon him is Taurus, the Wild Bull. His head is shown by the Hyades, a V-shaped cluster in which is the large red star Aldebaran, the Eye of the Bull.

A little farther to the west, in the shoulder of Taurus, is the well-known little cluster of the Pleiades, or the Seven Sisters. Long ago the Pleiades were used as a natural calendar by which agricultural and other operations were carried out. In ancient writings they are always spoken of as the Seven Stars, yet, for many centuries, only six stars have been easily seen to ordinary eyes. However, keen eyes may see more. One man was credited with being able to see thirteen—perhaps he had not read the lines—

"There was a young man of Cadiz,
Who was sent directly to Hades,
For he said, any night, with his keen sight,
He could see twenty stars in the Pleiades."

The planet near the Pleiades, marked by a round dot, is Saturn, while the one between Orion and Taurus is Jupiter. On the lower edge of the Milky Way is the brilliant star Capella, one of the finest stars in the northern heavens. Farther west, on the upper edge of the Milky Way, is Algol—the Demon Star; given such a satanic name, perhaps, because of its winking. Usually it is of mag. 2, but at regular intervals of 69 hours it fades to mag. 4. This is due to a dimmer companion, which at these intervals passes between us and the brighter star.

To the west of the Pleiades are two bright stars which mark Aries—the Ram—and farther, near the edge of the picture, are the two eastern stars of the Great Square of Pegasus. Not far from the upper star is Mars. The kite-shaped group, which points up toward the west corner, and has four stars streaming from its lower end, is Cetus—the Sea Monster. The upper star of the four is the very remarkable star Mira. In June and July, Mira was about mag. 3. Since then it has faded quite out of sight. It does this trick about every eleven months, but it is very irregular in all its ways. The reason for these vagaries is quite unknown.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1941 AND 1940, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall	
	Sept.	No. of years' records.	Sept., 1941.	Sept., 1940.		Sept.	No. of years' records	Sept., 1941.	Sept., 1940
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	0·72	40	0·29	0·34	Gatton College ..	1·47	42	0·11	0·59
Cairns	1·63	59	0·43	0·38	Gayndah	1·51	70	0·07	1·11
Cardwell ..	1·49	69	0·80	0·49	Gympie	2·06	71	0·09	1·88
Cooktown ..	0·56	65	0·17	0·83	Kilkivan	1·66	60	0·18	0·96
Herberton ..	0·54	55	0·15	0·20	Maryborough ..	1·87	70	0·10	1·39
Ingham	1·52	49	0·66	0·15	Nambour ..	2·35	45	0·27	0·31
Innisfail	3·48	60	1·07	1·11	Nanango	1·76	59	0·23	0·91
Mossman Mill ..	1·60	28	0·22	0·63	Rockhampton ..	1·24	70	0·06	0·28
Townsville ..	0·72	70	0·05	0·02	Woodford ..	2·09	54	0·15	1·29
Central Coast.					*Central Highlands.*				
Ayr	1·24	54	0·33	Nil	Clermont ..	0·97	70	Nil	0·86
Bowen	0·77	70	Nil	Nil	Gindie	1·01	42	..	1·22
Charters Towers ..	0·76	59	0·01	0·01	Springsure ..	1·25	72	Nil	0·82
Mackay P.O. ..	1·61	70	0·73	0·04	*Darling Downs.*				
Mackay Sugar Experiment Station	1·38	44	0·35	0·08	Dalby	1·64	71	0·14	1·53
Proserpine ..	1·95	38	0·21	0·32	Emu Vale ..	1·69	45	0·16	0·83
St. Lawrence ..	1·20	70	0·13	Nil	Hermitage ..	1·56	36	..	1·00
South Coast.					Jimbour	1·57	62	0·10	1·50
					Miles	1·30	56	Nil	0·92
					Stanthorpe ..	2·24	68	0·11	1·09
Biggenden ..	1·44	42	0·08	0·27	Toowoomba ..	2·05	69	0·26	0·96
Bundaberg ..	1·51	58	Nil	0·55	Warwick ..	1·79	76	0·09	1·22
Brisbane ..	1·96	89	0·48	0·75					
Caboolture ..	1·80	65	0·38	0·63	*Maranoa.*				
Childers	1·68	46	0·30	0·42					
Crohamhurst ..	2·57	48	0·55	0·42	Bungeworgoral ..	0·88	27	..	0·27
Esk	2·00	54	Nil	0·40	Roma	1·36	67	0·04	0·35

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1941.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	..	79	69	82	28	61	7	17	1
Herberton	..	76	52	86	30	37	6	15	2
Rockhampton	30·11	84	58	91	30	46	13	6	4
Brisbane	30·11	77	56	90·1	5	47	13	48	4
Darling Downs.									
Dalby	..	81	48	90	22	32	14	14	1
Stanthorpe	..	73	38	83	21, 22	26·1	13	11	2
Toowoomba	..	74	49	83	23	40	13	26	2
Mid-Interior.									
Georgetown	30·03	91	59	96	29	49	12	Nil	..
Longreach	30·08	88	52	95	26, 27	39	12	Nil	..
Mitchell	30·08	92	43	93	21, 22	30	13	3	..
Western.									
Burketown	..	86	62	98	30	55	12	Nil	..
Boulia	30·03	87	55	100	22	44	12, 14	Nil	..
Thargomindah ..	30·05	82	52	97	21	40	13, 17	Nil	..